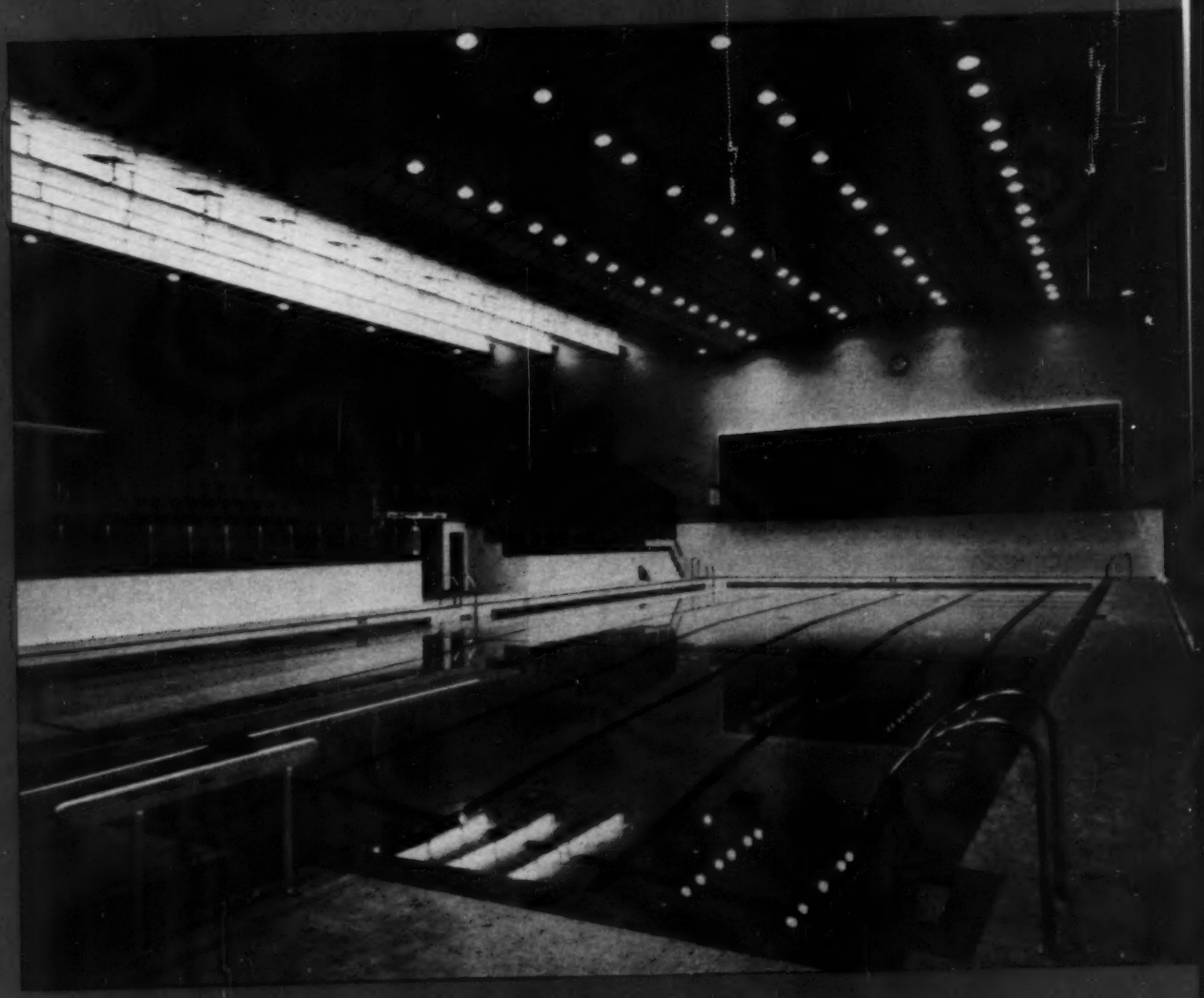
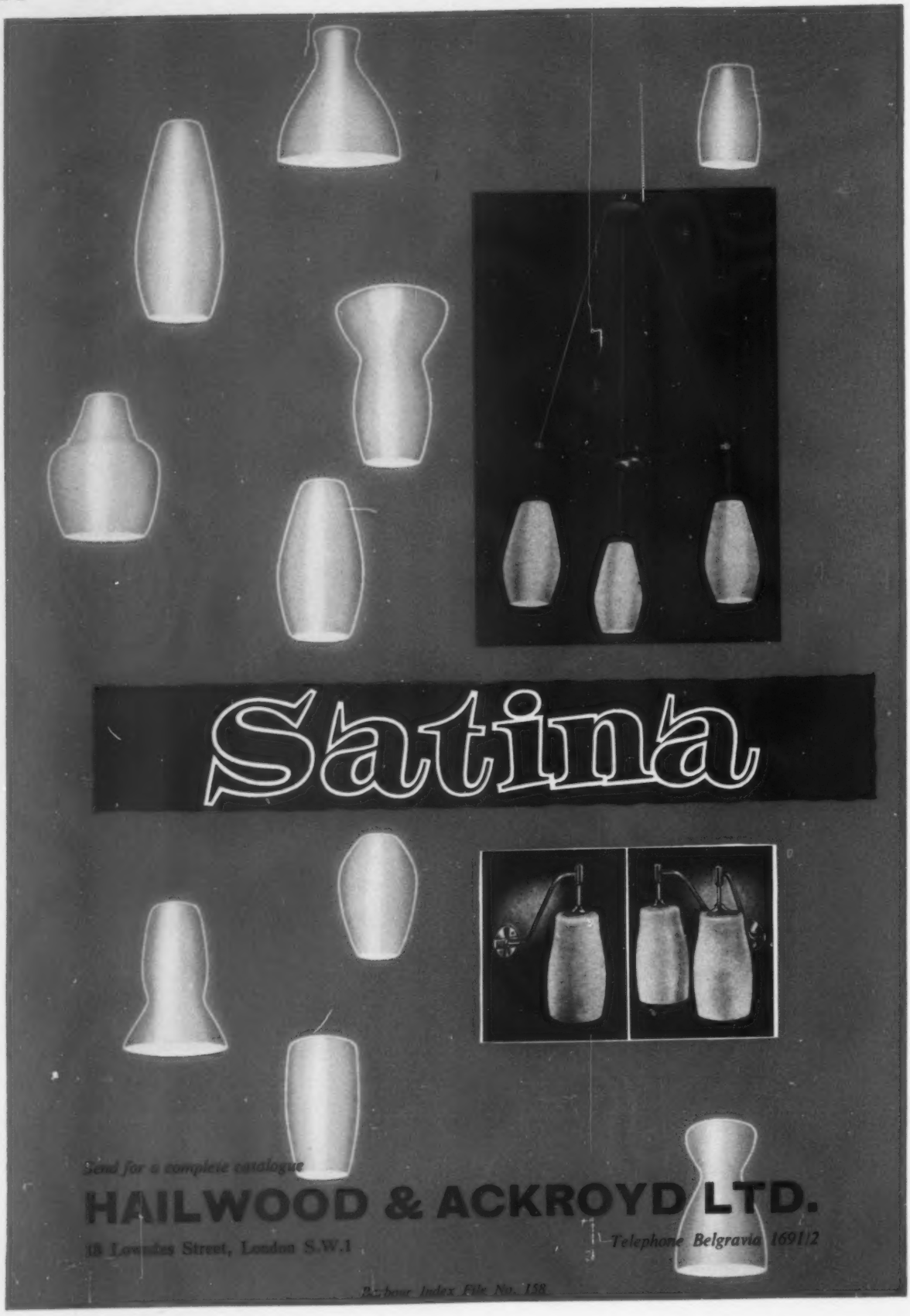
3s. 6d.

Light and Lighting

November 1961

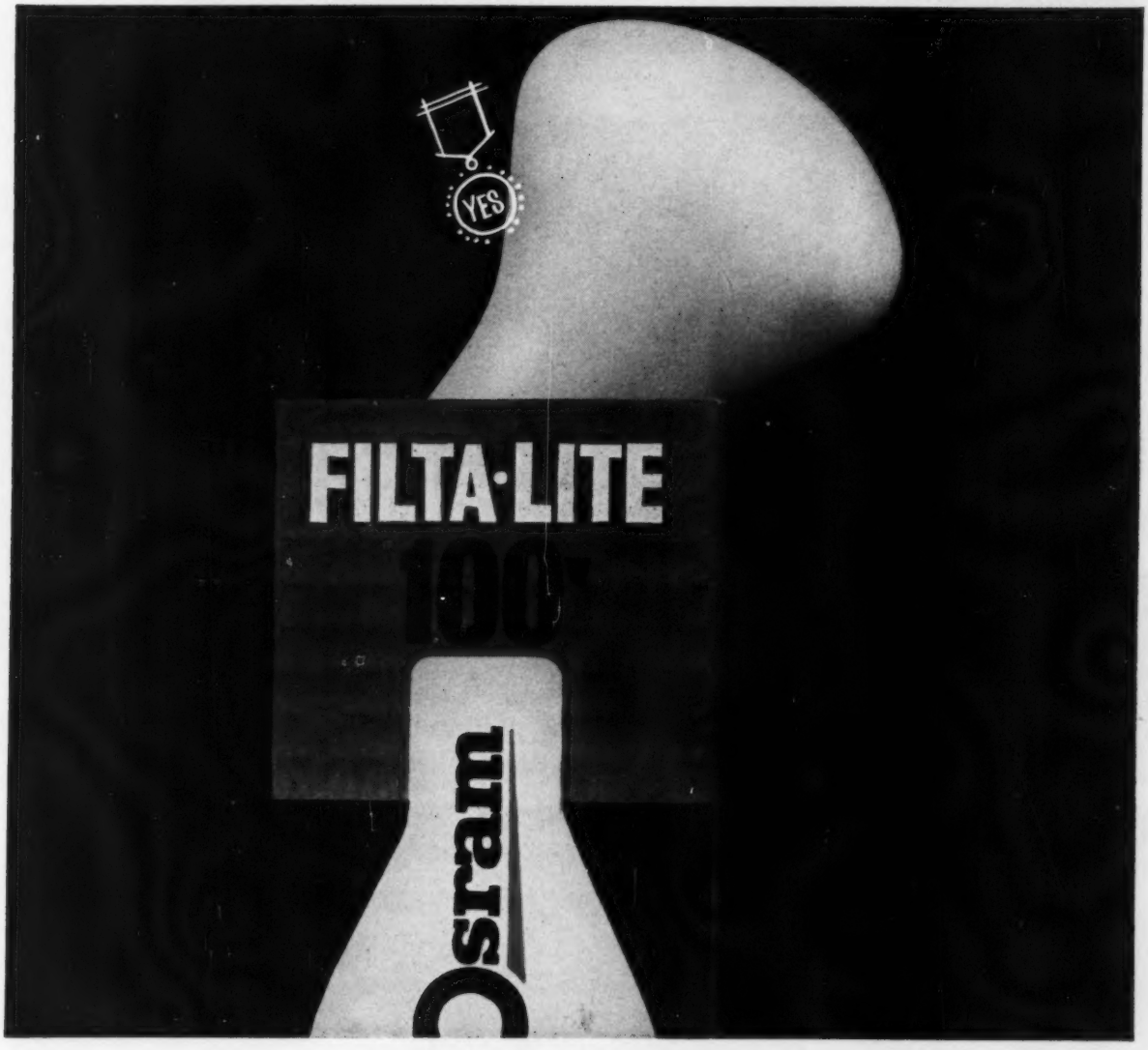


Combination of tungsten and fluorescent lamps skilfully used to enliven and enhance the intrinsic architectural interest of this new swimming bath at Walsall; additional information is given with a review of other installations included in this issue.


Satina
Send for a complete catalogue
HAILWOOD & ACKROYD LTD.
18 Lowndes Street, London S.W.1
Telephone Belgravia 1691/2
Purchase Index File No. 158

REVOLUTION!

OSRAM PRESENTS THE NEW FILTA-LITE BANISHES GLARE BRIGHTENS PROFITS



1. This unique bulb is specially coated on the inside surface to filter out glare and give the maximum light efficiency.

2. There are new bulb sleeves and zipper cases—which can be used as self-service units—all colour-coded for immediate wattage identification.

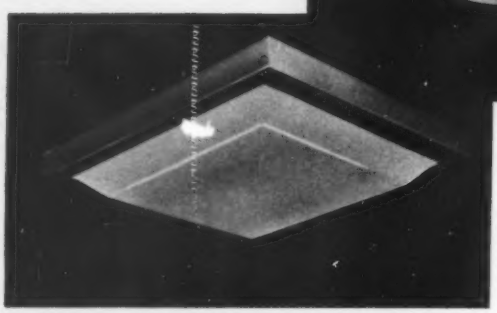
3. Hundreds of TV commercials and fortnightly press advertisements will bring customers to you for the revolutionary new Osram Filta-lite.

No. SL/1
150/200 w.
SATIN
OPAL
GLASS

No. DP 25. 2x5' 80 w. EXTRUDED PLASTIC DIFFUSER

DESIGNS
MAY BE SEEN
AT OUR
SOUTH HARROW
SHOWROOMS

CATALOGUES
AVAILABLE
ON REQUEST...
PHONE BYRON 3273-4



No. SM/324 3x2' 40 w.
OPAL PERSPEX DIFFUSER

S.L.R. Electric Ltd.

WELBECK WORKS, WELBECK ROAD
SOUTH HARROW, MIDDLESEX

Major Fluorescent Fittings

When the
Army & Navy Stores
decided to install up-to-date lighting in their new Stationery Department, their Chief Engineer Mr. H. R. Guest, designed an attractive fluorescent fitting. These give a soft, pleasant and restful illumination entirely without glare, and show the display goods to advantage.

Manufactured by
Major Equipment Co., Ltd.

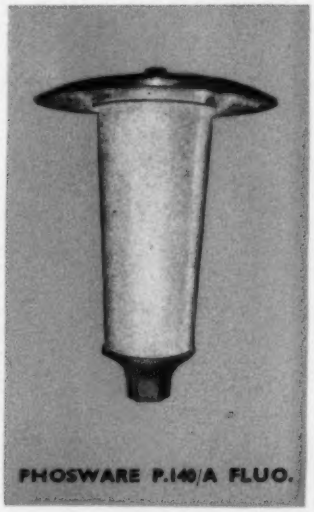
(Photo produced by permission of the Army & Navy Stores, Ltd.)

Catalogue on request

MAKERS OF QUALITY FITTINGS

MAJOR EQUIPMENT CO., LTD. 22, GORST ROAD . LONDON . N.W.10
Also Birmingham, Manchester, Coventry, North Shields, Glasgow ELGar 8041 (5 lines)

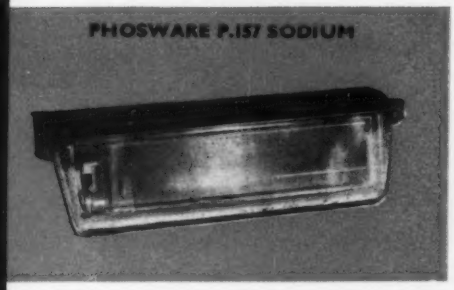
PHOSWARE
P.111 PROMENADE



PHOSWARE P.140/A FLUO.

FOR EFFICIENCY ECONOMY VERSATILITY

CHOOSE FROM THE
PHOSWARE RANGE

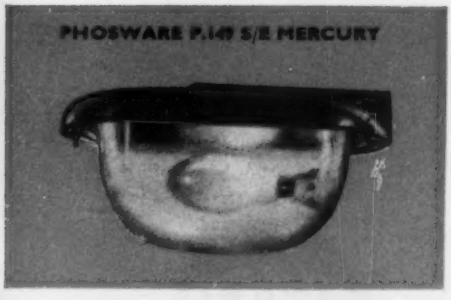


PHOSWARE

PHOSWARE P.167/A
POST-TOP

PHOSWARE P.142. FLUO

PHOSCO LIMITED
HOE LANE · WARE · HERTS
TELEPHONE: WARE 3466



Making a promise

Lighting installation in Conway Road, Llandudno. Photographs by kind permission of J. A. Edwards, Esq., B. Eng., A.M.I.C.E., M.I. Mun. E., A.M.T.P.I., Engineer and Surveyor of the Llandudno Urban District Council.

In the clear light of day, the obvious efficiency and functional grace of these Eleco street lighting installations make a distinct promise: that the road will be as safe for road users at midnight as it is at noon. Tall, elegant Elecoslim columns surmounted by Eleco Silver Ray lanterns that house Philips 250-watt MBF/U lamps, stand sentinel through all weathers — ready to dispel the night with brilliant, shadow-free light. This efficient, dependable street lighting scheme is just one of many installed throughout the country by Eleco and Philips. Their ever-growing fund of knowledge and experience in street lighting is available to you at any time.

ELECO

ELECO LIMITED · SPHERE WORKS · ST. ALBANS · HERTFORDSHIRE · ENGLAND

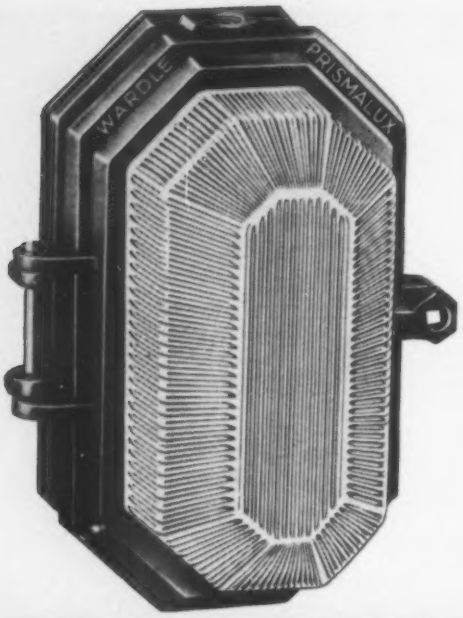
Walk down this road in broad daylight and you can see the promise of perfect illumination at night. Clear, safe lighting from Philips 250-watt MBF/U lamps is the promise inherent. The white light at extra high efficiency coupled with long reliable life brings the promise to life. At night, when these Philips lamps come on, there is indeed brilliant, clean light that reduces the risk of accident . . . ensures maximum safety for every road user. Philips and Eleco have together solved many street lighting problems throughout the country. Their specialist experience is available to you whenever you need it.

Lighting installation in Conway Road, Llandudno. Photographs by kind permission of J. A. Edwards, Esq., B. Eng., A.M.I.C.E., M.I. Mun. E., A.M.T.P.I., Engineer and Surveyor of the Llandudno Urban District Council.

PHILIPS ELECTRICAL LTD Lamp & Lighting Group

CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON W.C.2

PHILIPS



PRISMALUX

DIRECTIONAL LIGHTING UNITS

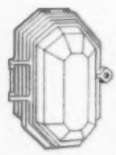
EFFICIENT ILLUMINATION
WIPE CLEAN SURFACES, ADAPTABLE DESIGN
DEPENDABLE WORKMANSHIP, LASTING QUALITY

The economies offered by Prismalux—easy installation, no servicing, a lifetime of use—have resulted in the specification of this unit for a range of applications wider than we visualised when designing it. Word seems to have got round that the best bet for the illumination of any dark spot is Prismalux... the Wardle product!

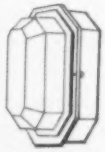
★ *Completely weatherproof, dustproof*
★ *Prisms moulded on inner surface*
★ *Solid cast iron body*
★ *Stove enamelled or galvanised finish*
★ *Vitreous enamelled reflector*
★ *Choice of seven inlets*
★ *Porcelain B.S. skirted lampholder*

All types can be supplied with rust resisting, strong wire guard.

TILTED for subways, arches, cable and conduit runs.


STANDARD for all applications

DETACHABLE COVER TYPE for corners, cellars, arches.


RECESSED for low ceilings and confined spaces.

THE WARDLE ENGINEERING CO. LTD
OLD TRAFFORD, MANCHESTER 16
Telephone: TRAfford Park 1801
London Office: 34 Victoria St., S.W.1 Telephone: 4072 and 1356

ASK

LUMITRON

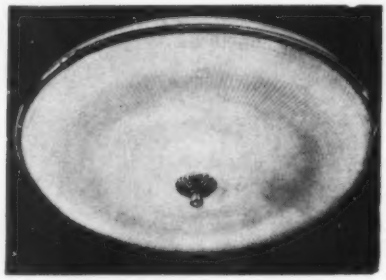
EVERY TIME YOU NEED...

WELL DESIGNED
LOW COST FLUORESCENT

LIGHT FITTINGS

ITALIAN RANGE. Another elegant model from our ITALIAN range. With perspex diffuser and polished brass band.

	C.S.	WIDTH	TUBE SIZE
LIDO 34	£21 19 8 + 55/10 P.T.	12½"	3×40W
LIDO 35	£26 19 8 + 68/9 P.T.	12½"	3×80W



ITALIAN RANGE
Another delightful model from our ITALIAN range. With designed Polistrol transparent diffuser and brass band.

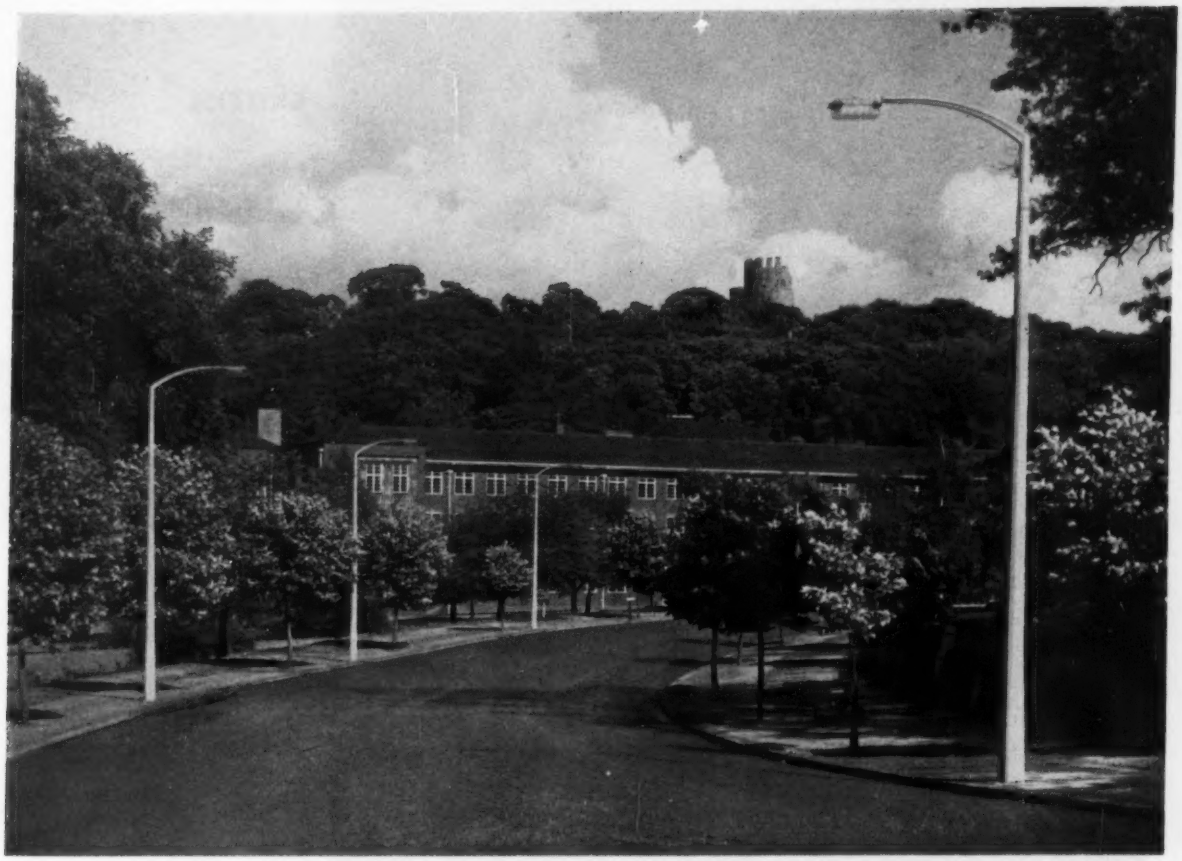
CIRCO 14		
S.S.	P.T.	SIZE
£6 19 8 +	14/6	1×40W

TUBE
£1 17 6 + 5/2

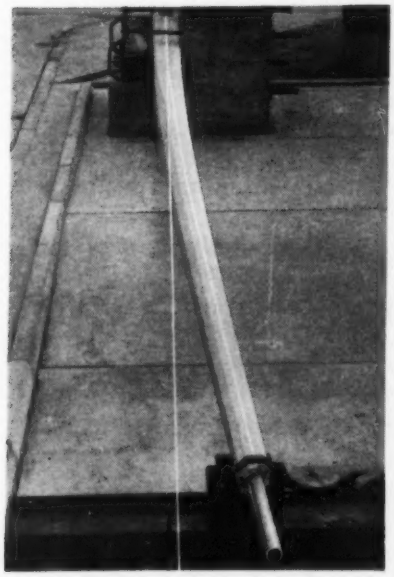
LUMITRON
MANUFACTURERS OF CONTEMPORARY LIGHTING FITTINGS
Showrooms and Trade Counter
180 SHAFTESBURY AVENUE, LONDON, WC2
COVent Garden 0126/7

LUMITRON
Works and Trade Counter
HYTHE ROAD
SCRUBBS LANE
NW 10
LAD 2262/3

Send for latest fluorescent catalogue



Photograph of one of our many designs acceptable to the Ministry of Transport for use on trunk roads and approved by The Council of Industrial Design.



STANTON AND STAVELEY

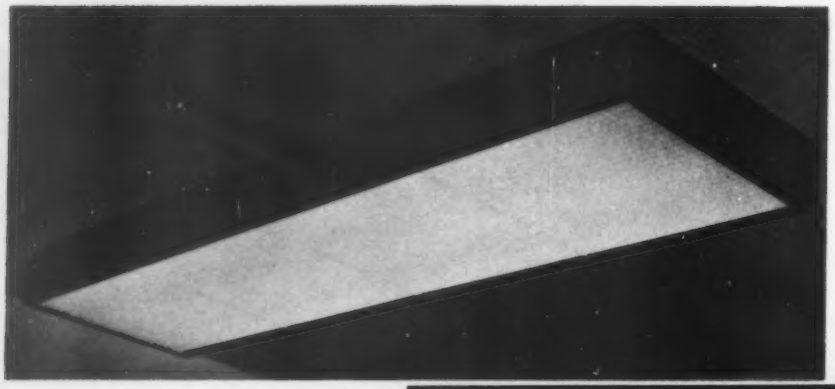
Prestressed Spun Concrete Lighting Columns

Type 8F Spun Concrete Lighting Columns at Dudley, fitted with Revo C.15342 lanterns.

Photograph by courtesy of D. S. Warren, A.M.I.C.E., A.M.I.Mun.E., Engineer and Surveyor, Dudley.

Spun concrete column under a load of 1,092 lb. showing a deflection of 13½ inches. (The British Standard 1308:1957 proof test load is 320 lb.)

Stanton and Staveley Sales Limited. Near Nottingham



BRISTOL

CAT. NO. 28244
TWIN 80W. FITTING

I.E.S. CODE 1961

LUVELINE III

CAT. NO. 28263
TWIN 80W. FITTING

For office lighting fittings which conform to the latest recommendations of the Illuminating Engineering Society and for all lighting equipment which combines utility with good design see the Harris and Sheldon range at their Birmingham and London Showrooms or write for fully descriptive literature.

Harris & Sheldon ELECTRICAL **Ltd**

STAFFORD ST BIRMINGHAM CENtral 6272 · 46 GT. MARLBOROUGH ST LONDON W1 GERrard 0869

THE HARRIS AND SHELDON GROUP OF COMPANIES · SHOPFITTING · INTERIOR DECORATION · DISPLAY

AEI
illuminate
the new
IES Code

FREE

If you have anything to do with lighting specifications, you almost certainly know about the new I.E.S. Code. ✻

Now A.E.I. have produced a Lighting Performance Data Sheet to be used with the new code, to help you plan the most precise and up-to-date lighting installations.

Most of the data relates to the A.E.I. Series 2 fluorescent fittings. Exacting engineering and simplicity of design have made these fittings the choice of all really enlightened lighting experts.

Ask A.E.I. for your free copy of this helpful, lucid material. Write to the A.E.I. Lamp and Lighting Co. Ltd., Publicity Department, 44 Fitzroy Road, London, N.W.1.

✻ If you don't have a copy of the I.E.S. Code yet, send 12/6 to: The Secretary, Illuminating Engineering Society, 32 Victoria Street, London, S.W.1.

M4934

NEWEL FITTINGS
&
OUTSIDE BRACKET LIGHTS
— *WEATHERPROOF* —

Accepted by The Council of Industrial Design for Design Index

For the Small Craft Builder
our Miniature Lighting Fittings

Manufactured by

SATCHWELL & GITTINGS LTD.
TANTARRA ELECTRICAL WORKS
WALSALL. ***Telephone: Walsall 22313***

Send for full list.

ADASTRA
ZETA COLUMN

Zeta column with post top lantern for 2/40w or 4/40w fluorescent tube.

A ONE PIECE STEEL COLUMN

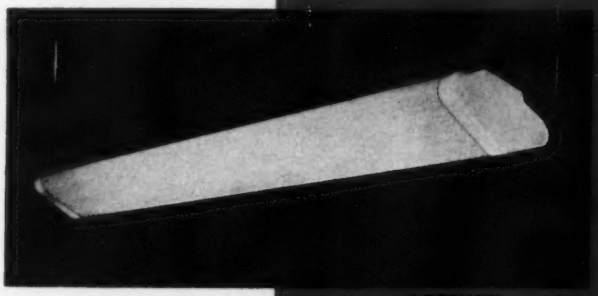
Eminently suited for all kinds of Group 'B' lighting, of graceful and pleasing appearance.
The column is manufactured from steel and is circular. After manufacture it is heavily coated with zinc inside and outside by the hot dip galvanising process. The finish is noted for its durability in applications outdoors.
As a preparation for painting, phosphate treatment of the galvanised surface is recommended and column can be phosphated before leaving the factory.
Standard heights are 12', 13' and 14' above ground.
The top diameter is 3", the depth in the ground is 2'6" and a service slot 6" x 3" is provided in the root.
Single or double brackets for pendant or side entry lanterns can be provided.
The 14' column weighs only 80 lbs and can easily be erected without any lifting appliances.
The column complies with requirements of B.S.S. 1840-1960.

POLES LTD

Head Office and Works: Tyburn Road, Erdington, Birmingham 24
Telephone: ERDington 1616
Cables "Poles Birmingham"
London Office: 98 Park Lane W.1.
Telephone: MAYfair 3074

CONSTRUCTORS GROUP

EKCO-ENSIGN "ESSEX RANGE"



'LOZENGE'

'COBURG'

'GELONG LOUVRED'

This range of lighting fittings is produced in Opal 030 Extruded Diakon, $\frac{1}{4}$" fluted internally and available in 4ft, 5ft and 8ft lengths. Made to customer's design by Wokingham Plastics Ltd.

WOKINGHAM PLASTICS LTD

DENTON RD. WOKINGHAM BERKSHIRE

Telephone: WOKINGHAM 700/701 • A.I.D. and A.R.B. Approved

lights that look after themselves

—only Victor Fittings feature minimum maintenance design

Fluorescent lighting suitable for pedestrian and traffic subways, tunnels, and landings and vestibules in Public Buildings, Flats, etc.

Write today asking for leaflets L300 LI 300 for fuller details.

Victor

VICTOR PRODUCTS (WALLSEND) LTD.

WALLSEND-ON-TYNE, ENGLAND. *Tel: Wallsend 628331 Cables: 'Victor', Wallsend, England.*
London Office: 1327 London Road, Norbury, S.W.16. *Tel: Pollards 0077*

Miniature Fluorescent Lighting Fitting

Cast Aluminium Alloy Lighting Fitting

I/L1

you have never seen OFFICE LIGHTING like this before . . .

Pleasant working environments with accompanying efficiency call for reasonably high levels of illumination—but such high level illumination must be free from discomfort glare.

Merely to increase the light source brightness results in excessive glare from the lighting fitting. The answer is low brightness fittings of high luminous output—"Comfort in Lighting" fittings developed by G.E.C.

The G.E.C. range of "Comfort in Lighting" fittings is the only one which meets the recommendations for every type of installation of the new Code for Good Interior Lighting issued by The Illuminating Engineering Society.

You could see lighting like this every day in *your* office, by installing G.E.C. "Comfort in Lighting". Write for the 40 page illustrated brochure F4695 or better still, ask us to send a Lighting Engineer. Our Lighting Advisory Service is entirely free and without obligation.

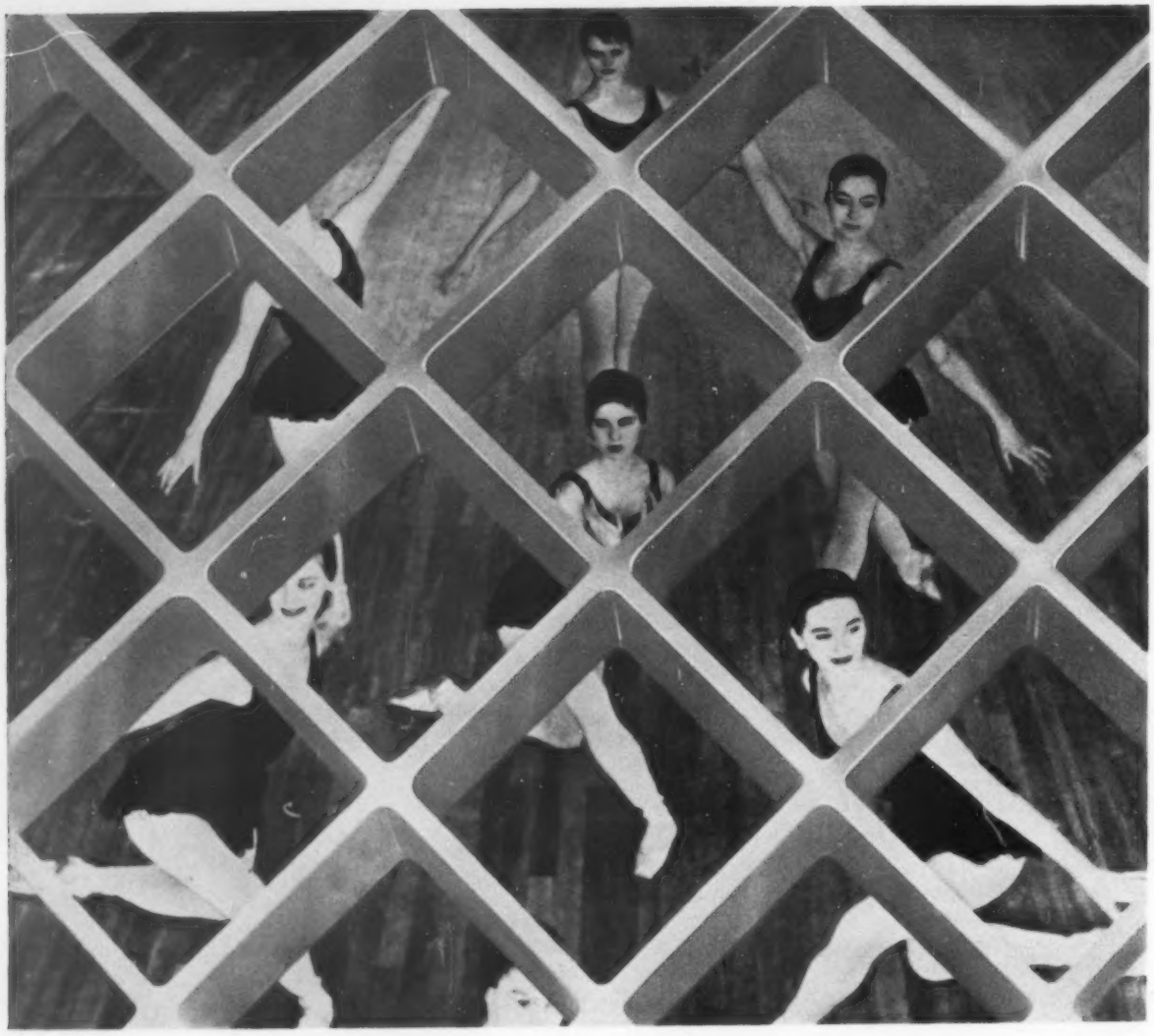
comfort in lighting

means high level illumination without discomfort glare.

G.E.C.

LIGHTING & HEATING GROUP

LIGHTING AND HEATING GROUP · THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE · KINGSWAY, LONDON · W.C.2



Light fantastic

Light on her feet, light above her head. There was a time when ballet was danced by candlelight – but a long time ago. Long before Shell gave us 'Carinex' light-stabilised polystyrene.
The grille through which you see our ballerinas, is made from 'Carinex'. It is durable, attractive and available in many grades and in all colours.
That's why it is so suitable for lighting fittings.

CARINEX
POLYSTYRENE

Shell Chemicals

SHELL

Ask Shell Chemical Company Limited
Plastics & Rubbers Division, 170 Piccadilly, London, W.1

SHELL and CARINEX are Registered Trade Marks

PS3

Light and Lighting

Vol. 54 No. 11

Editor: G. F. COLE

Assistant Editor: D. B. WILLSON

CONTENTS

Notes and News: First IES meeting of the new session — Electrical Engineers' Exhibition Dinner — Electricity Council's report for 1960 — Industrial accidents in 1960 — New factory in Scotland — Fittings data **(page 322)**

Lighting under an umbrella roof: Technical account of problems posed by hyperbolic paraboloid roof at new factory and description of lighting installation evolved **(page 324)**

Photometry and colorimetry at the National Physical Laboratory: Review by G. E. V. Lambert and J. S. Preston of work on which NPL is engaged, indicating respective functions of Light Division and Test House **(page 327)**

Apparent brightness — The measure of what we see: Resumé by Dr R. G. Hopkinson of concept of apparent brightness and discussion of way it can be used by lighting engineers, with a practical example **(page 330)**

New hotel overlooking Hyde Park: Description and illustrations of lighting and décor in the Hertford Hotel **(page 334)**

Lighting installations: Industrial — motor car showrooms — drawing offices — bank — church — lecture theatre **(page 336)**

Lighting abstracts: Recently published work on lighting and allied subjects **(page 342)**

New Products: Information on recently introduced lighting equipment **(page 345)**

IES Activities: Presidential address and presentation of Gold Medal — Centres' meetings — News — Forthcoming events **(page 348)**

Miscellany: Book reviews — Educational — Personal — BLC activities — Industrial Notes — Situations **(page 350)**

Postscript: by 'Lumeritas' **(page 352)**

Published by the Illuminating Engineering Society at 32 Victoria Street, London, SW1 (ABBey 7553). Printed in England by the Sheneval Press, Simson Shand Ltd, London, Hertford & Harlow. Annual subscription 2 g s.; single copies 3s. 6d.

Lighting Research

Recent events in the lighting world, such as the publication of the new IES Code with, amongst other things, its revolutionary proposals for the control of glare, IES Technical Report No. 2 on coefficients of utilization, and the recent IES presidential address with its challenges on future developments in the art and technology of lighting, prompt us to ask just how much lighting research — that is research into lighting techniques and applications — is being carried out in this country and to what extent it is co-ordinated. It is well known, of course, that the NPL and BRS make valuable contributions to lighting and that some of the larger commercial laboratories do not confine their research activities only to lamps and equipment but also deal with the broader issues of applications. Nevertheless one would be hard put to write down the names of people doing research on lighting in the same way as one could immediately list those who are working on new lamps and materials. And when it comes to co-ordination is there any attempt at co-ordination other than through the IES Technical Committee? Which prompts us to go even further and ask, bearing in mind the example given by the IES publications mentioned above, is there any better body to bring together all those concerned with the development of lighting with all it involves? It may be difficult — though not impossible — to set up something comparable with the Illuminating Engineering Research Institute which operates in the USA but, as will have been observed from the brief report on the activities of that body which was given in our last issue, the Americans have got a lot of things moving — and not all concern just higher levels of illumination. Perhaps the IES Technical Committee is our counterpart to the IERI but it doesn't have anything like the same resources. The Technical Committee has already shown that a higher degree of co-operation and co-ordination than some people thought possible can be achieved. The potential value to the industry is obvious. We would suggest that the time has come to arm the IES.

SHELL and CARINEX are Registered Trade Marks

PS3

Notes and News

THE NEW SESSION OF THE IES got off to a good start at the Royal Institution on October 10. The traditional venue and the dignity of the proceedings are major factors contributing to the success of the first meeting of each session which has become one of the most important in the IES calendar. The meeting turns, of course, on the installation of the new president and on his address and Mr Souter's choice of subject, the Society's contribution to lighting technology, was particularly timely. A summary of the address appears elsewhere in this issue and here we would like only to refer to Mr Souter's comments on the future technical work of the IES. His review of the past was most useful in helping us to get things into the right perspective and it is clear from the events of the last few years—the new Code, Technical Reports, group discussions at Summer Meetings—that the Society is playing a very prominent part in the development of lighting technology. But, as Mr Souter pointed out, though we are travelling in the right direction, a lot of work remains to be done before lighting engineers can reasonably predetermine and calculate all the variables affecting efficiency and comfort in seeing and can then enjoy the greater freedom it will afford in the practice of the art of lighting. The challenge of such problems as reflected glare, colour, the integration of lighting with other services, will only be resolved by the support of the Society by all members. Mr Souter's address will be published in the *Transactions* in due course and we hope all members, both individual and sustaining, will study it carefully and determine to give the Society the active (and, may we add—financial) support that it so richly deserves.

And talking of things richly deserved brings us to the award of the IES Gold Medal to Mr H. C. Weston, the presentation of which took place at this meeting. Weston's contributions to lighting knowledge dating from the early 1920s are so well known that any attempt to detail them here would be superfluous; discussed and challenged in various parts of the world they have stood the test of time and without them the IES would not today be enjoying the high technical reputation that it does. Our congratulations, and we are sure those of all readers, go to Mr Weston.

Electricity supply 1960-61

THERE IS BUT ONE REFERENCE to lighting in the annual report of the Electricity Council for 1960–61, published recently by HMSO at 9*s*. 6*d*. This occurs in the chapter devoted to commercial operations and records that further developments in street lighting systems contributed to the total sales for these purposes of 789 million units, an increase of 8·2 per cent over the previous year. Sales of electricity for public lighting are, of course, the only separate classification of electricity consumption for lighting purposes and these, in fact, amount to only 0·8 per cent of the total sales to consumers for all purposes. The report also mentions that there have been numerous conversions from tungsten filament lamps to discharge lamps and that in many cases conversion is accompanied by an upgrading of the standard to which the road is lighted. Public lighting is responsible for an income of £5,128,652 compared with £4,716,932 for the previous year. Revenue from this source varied from 1·253 pence per unit sold in the Midlands Electricity Board to 1·81 pence per unit sold for the South Eastern and Southern Boards; the average over the twelve boards is 1·56 pence per unit sold, compared with 1·553 for the previous year. Total consumption by commercial consumers amounted to 11,981 million units, corresponding to a total income of £99,661,634; it has been estimated that just over half is accounted for by lighting. Sales to domestic premises amounted to 31,636 million units (£212,601,671) and to farms 1,793 million units (£11,753,503), and although there is no reliable indication of the proportion used for lighting, it seems reasonable to suppose it is between 30 and 50 per cent.

Terminals in the making

THE LARGE SCALE ADOPTION of solderless connections and terminals for wire and cable, particularly in the electronic and aircraft industries, is something of a minor revolution in wire termination. Instead of the familiar method of soldering, the wire or cable end is crimped by pressure into its terminal in such a way that the individual strands of a cable become homogeneous and are virtually fused to the terminal material at the pressures exerted in the crimping tool. One of the pioneers of this form of connection is the American firm, Aircraft-Marine Products, whose British subsidiary now have a new factory at Port Glasgow, opened recently by the Rt Hon John S. Maclay, MP, CMG, Secretary of State for Scotland. The key point in the production of the terminals is the bank of presses on which they are produced in continuous strips and the firm is probably unique for Scotland in its use of an optical profile grinder for shaping the dies used in the presses. The profile of the die being ground is projected on to a screen which carries a drawing of the desired profile; in this way it is possible to shape the profile to an accuracy of 0·0001 in. The firm, however, is probably not unique in its form of lighting; the production area is lighted from 8 ft batten 'Popular Pack' fittings mounted on runs of trunking. The glare is less noticeable than it might be, because of the

use of reflector lamps—is there, one wonders, a BZ classification for such an arrangement? The effect was not improved by having a significant number of the lamps mounted upside down, unless, of course, this was a further glare control measure.

Industrial accidents in 1960

LAST YEAR WAS A BAD YEAR for industrial accidents; all told, 190,266 accidents were reported from premises subject to the Factories Acts, an increase of 16,195 (9 per cent) over the total for the previous year. Of these accidents, 675 were fatal, compared to 598 in 1959. These figures are given in the Annual Report of the Chief Inspector of Factories, published recently by HMSO at 7*s*. The contribution that good lighting can make to industrial safety is acknowledged briefly in a special section of the report devoted to accidents and their prevention in the lifting, moving or carrying of goods and materials. Whilst urging the use of mechanical handling wherever practicable, the report points out that where manual handling of goods remains a necessity the best insurance against accident will be the provision of good working conditions and observances of safe practices; proper heating, ventilation and lighting and adequate movement space are regarded as essential. Elsewhere in the report, attention is drawn to good and bad features of the planning and design of new factories. Extensive glass walling is recognised as giving good natural lighting but architects are asked to bear in mind the serious problems of external cleaning which result. Mention is also made of the building of a number of factories with little or no window space and provided with permanent artificial lighting.

ASEE Exhibition Dinner

THE SECOND ANNUAL DINNER arranged by the Electrical Engineers (ASEE) Exhibition company at Grosvenor House on September 28 was attended by about 800 people including more ambassadors and other members of the Corps Diplomatique than one could easily count. The continuing and increasing interest of overseas governments and buyers in the products of our electrical industry is of course vital, and the ASEE does very well in its publicity and public relations in this direction. Much of the content of the speeches, however, concerned export and in particular the future prospects of the industry if the UK enters the Common Market, and one wondered whether the hopes, fears, threats and encouragements which were mentioned might not have been differently and more emphatically put if the audience had comprised only representatives of manufacturers and exhibitors. Also one felt that comments on the advantages of price maintenance agreements and the dangers of unrestricted cut-throat competition were less suitable for the ears of the representatives of overseas governments who were present than for the ears of Ministers in our own government, none of whom were present.

All this talk of tearing down trade barriers and the like took place under the light from eight vast crystal glass chandeliers which John Reid (who has recently completed the commission of relighting and decorating the Grosvenor House ballroom) had imported from Germany because he couldn't find what he wanted in this country. Most people present seemed to be aware of this fact, but we hope they also appreciated that it is now possible to read the small type of a menu card without strain; the illumination at table level was formerly only 1 lm/ft²—it is now 15. This ballroom is said to be the largest in Europe; until recently it must also have been the dullest. Probably no one but John Reid would have thought of putting in chandeliers on this scale but the transformation is outstandingly successful.

We cannot leave this item without commenting on the lighting of the Park Lane–Hyde Park circuit which one has to enter on leaving Grosvenor House. Though road improvements are still far from complete, the traffic in this circuit flows so fast that one is reminded of driving in the Champs Elysees. The present lighting is so inadequate, particularly around Hyde Park Corner, that it is a wonder anything emerges unscathed. We gather that Atlas lanterns using colour-corrected mercury lamps on Stewart and Lloyds 40-ft steel columns are to be used to relight this area—and we hope that will be fairly soon.

Fittings data

FOLLOWING OUR NOTE LAST MONTH on the publication by AEI of BZ classification data for their fittings we understand that Atlas have issued similar data (which is to be followed up shortly by a more comprehensive handbook), and as we go to press a lavish GEC publication has appeared. This describes the principal features of the IES Code and gives a number of easy-to-follow examples of glare index evaluation. The implications of the new IES system are discussed, after which IES Technical Report No. 2, the BZ method and classification, terminology, cavity principle and all that are described in fairly simple terms with further worked examples on the evaluation of coefficients of utilization. The very useful graphs included by Rowlands in his recent article in *Light and Lighting* are reproduced and data relating to GEC fittings are tabulated at the end of the book. This publication is, we understand, intended for architects, consultants, industrial and commercial users and electrical contractors amongst others. It is, of course, primarily concerned with the glare recommendations of the Code; we hope that all people who get this, and for that matter all other commercial and promotional publications of a similar kind, will also get and read the Code, an understanding of which is essential in the planning of good lighting.

Lighting under an Umbrella Roof

PROBLEMS POSED BY HYPERBOLIC PARABOLOID STRUCTURES AT NEW SEMI-CONDUCTOR FACTORY

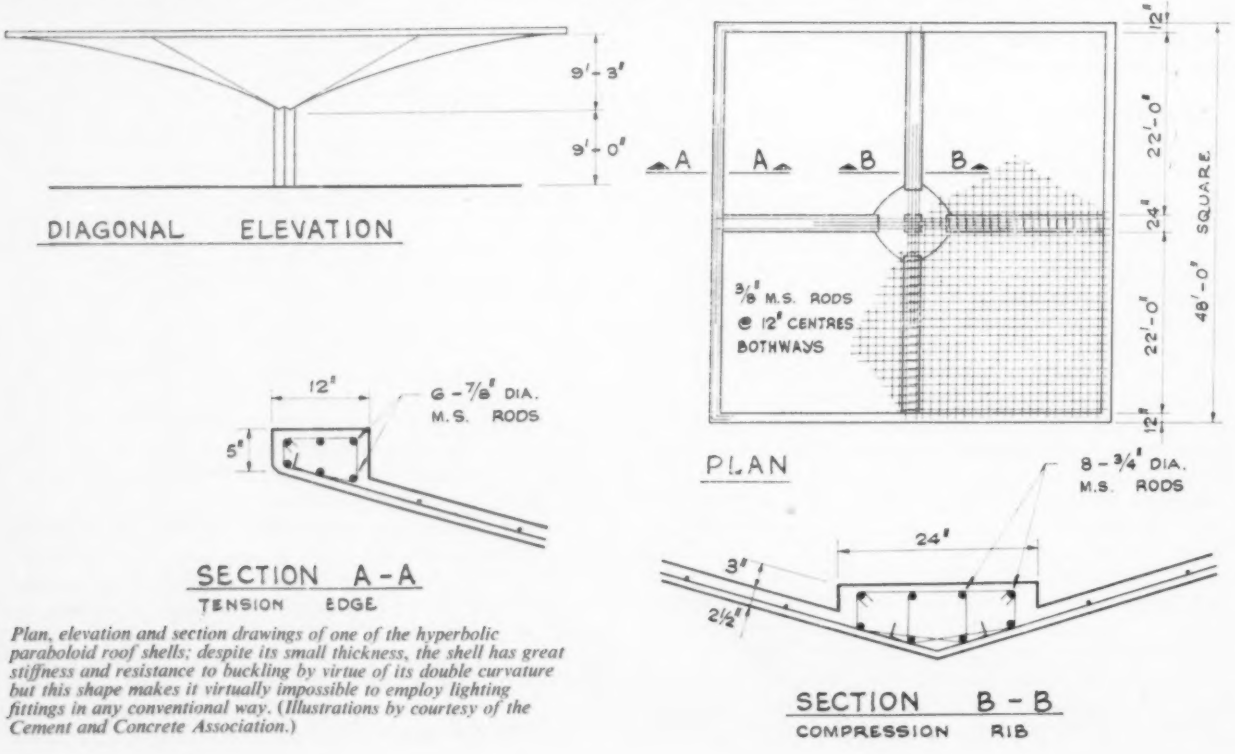
NEED TO MINIMISE BUILDING COSTS has stimulated a variety of new building techniques of which one of the more unusual is the hyperbolic paraboloid roof construction, more popularly known as the umbrella roof. As is often the case with new techniques, however, this form of construction presents new problems for the incorporation of services, notably in its lighting and the solution adopted for the new factory of Texas Instruments Ltd at Bedford is of particular interest.

The new factory, devoted to the manufacture of semiconductor devices, forms part of the firm's first major building structure in a programme of development. When complete, the structure will comprise a three-storey office block 270 ft long by 50 ft wide, surrounded on all sides by the manufacturing area, laid out in the form of a hollow square of 430 ft side and varying in width from 50 ft to 100 ft. At present, the office block and two-thirds of the manufacturing area have been erected.

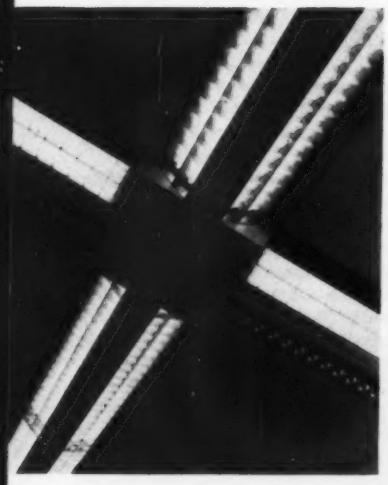
The main technical requirement in the design of the manufacturing area was complete flexibility, as production lines are required to be revised constantly. In view of the delicate nature of the manufacturing process, a high standard of cleanliness has to be maintained, with rigid control of air temperature and humidity, to which end a large air-conditioning plant has been installed. Apart from its delicacy, the process is complex, requiring a variety of piped services; it was also an essential requirement that the illumination in the manufacturing area should not fall below 50 lm/ft².

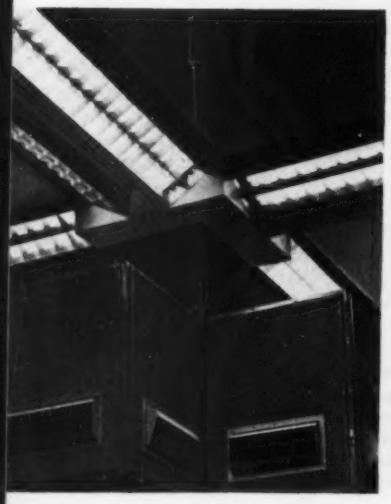
The construction of the manufacturing area is of hyperbolic paraboloid umbrella units 48 ft square, arranged in a double row for two sides of the area, and in a single row on the third side. Each 48 ft square unit consists of a reinforced concrete roof shell, only 2½ in. thick, rising through 9 ft from the springing to the edge, which is 18 ft above floor level. Each shell stands free, entirely independent of its neighbour, from which it is separated by a gap of 3 ft 6 in., and is supported on a single column rising about 20 ft from the structural floor. The manufacturing floor comprises a concrete slab cast on the structural floor round the columns and then lifted by hydraulic jacks through some 9 ft, being supported in its final position by steel shear plates welded to a helmet box fixed to each column. The space created below the manufacturing floor is used to house the services. The office block was also built on this lift-slab principle.

The sides of the manufacturing area are of aluminium window-walling for their full height; with external brick towers provided at intervals to provide service shafts between the manufacturing area and the services space below. Much of the glazing for the window-walling, however, is tinted to minimise both sun glare and solar thermal gain, so that the required illumination is provided permanently by the artificial lighting.



Plan, elevation and section drawings of one of the hyperbolic paraboloid roof shells; despite its small thickness, the shell has great stiffness and resistance to buckling by virtue of its double curvature but this shape makes it virtually impossible to employ lighting fittings in any conventional way. (Illustrations by courtesy of the Cement and Concrete Association.)





Above, view over part of the manufacturing area at Texas Instrument's new factory showing the general impression of the unorthodox roof structure and lighting. Below is a closer view of one of the 'halo' fittings. To the left are seen detailed illustrations of the lighting fittings and junctions; a special sheet-steel casing carries the fittings at their correct angles and houses control gear and wiring

Above, part of the office area, lighted by a wall-to-wall luminous ceiling to 75 lm/ft². Immediately below shows the canteen, lighted to 20–25 lm/ft² by twin continuous rows of fluorescent lamps in timber enclosures. At foot of page, an external view of the manufacturing area shows the brick service piers and window-walling.

As will be appreciated, the provision of uniform artificial lighting with a roof structure of this kind presents a number of difficulties, arising from the size, independence and unusual curvature of each shell, and it was found necessary to provide the lighting at two different mounting heights. The major contribution is from the higher level lighting system which utilises the gap between the shells. This gap is bridged at intervals by brackets, flexibly mounted to retain the individual freedom of movement of each shell. The brackets are then used as fixing points for continuous rows of twin-lamp louvered fittings of the GEC's 'Comfort' range. In this way, each shell is provided with lighting on all four sides, using six 8 ft fittings per side. To improve uniformity of illumination, however, it was found necessary to rotate the fittings axially through an angle of 30°, so that they were 'beamed' in towards the centre of each shell.

It will be realised, of course, that in a conventional lighting installation, the effect of rotation of fittings in this way would be to cause glare, by making the lamps visible to the occupants. The geometry of the roof, however, is such as to provide its own cut-off, so that no more than one line of fittings can normally be seen from the working positions, this being the row bounding the roof unit under which the particular occupant is working.

The basic installation provided in this way thus takes the form of a grid 50 ft square and, in conjunction with the geometry of the roof, results in a marked fall-off in illumination level at the centre of each square. To counteract this fall-off, the main lighting is supplemented by a 16 ft square 'halo' of twin-lamp 8 ft 'Comfort' fittings suspended round the centre of each roof shell at a mounting height of 9 ft, and open at the top to provide some upward light on to the roof surface. Measurements taken on the completion of the scheme show the illumination level on the diagonal of each 48 ft square to diminish uniformly from a maximum of 150 lm/ft² to about 50 lm/ft² at the column. On a radial line perpendicular to one side, measurements at 5 ft intervals were, from the periphery inwards: 75, 70, 55, 60, 60 and 50 lm/ft², at 3 ft above floor level.

The lighting of the office block is also notable for the use, throughout, of a wall-to-wall luminous ceiling, of corrugated vinyl strip, from Crompton Parkinson's 'Modulume' system. The requirement here was that the illumination should not fall below 75 lm/ft². This is achieved using 5 ft 'white' fluorescent lamps mounted in continuous, overlapping, rows at 4 ft centres in the 2 ft 2 in. ceiling void, which is painted white.

The architects for the building were O'Neil Ford and Richard Colley and the consulting engineers Oscar Faber and Partners. General contractors were Tarmac Civil Engineering Ltd and electrical contractors Rashleigh Phipps and Co Ltd.

Photometry and Colorimetry at the National Physical Laboratory

This is a review article enumerating most of the facets of work in photometry, colorimetry and vision in which the National Physical Laboratory is at present engaged. The respective functions of the Light Division and the Test House in these fields are indicated, and the services and responsibilities of the Laboratory to industry and to other national laboratories are outlined.

By G. E. V. LAMBERT, BSc, FIES
and J. S. PRESTON, MA, MIEE, FInstP, FIES

AT THE National Physical Laboratory, photometry and colorimetry come within the province both of the Light Division, which is responsible for maintenance of standards and research and development, and of the Test House, which offers an up-to-date and comprehensive service of photometric tests on lamps.

In the Division some research on vision is included because, although physical methods of measurement are now almost universal, correlative information about the eye is necessary for the interpretation of results. Moreover, radiometry is closely linked with photometry and colorimetry because visual stimuli are best defined physically in terms of radiant power and wavelength, and this approach seems likely to lead eventually to a definition of the unit of light based upon the measurement of radiant power instead of upon a material primary standard. The essential work of the Division includes not only the maintenance of the national standards of light, of colour temperature, and of radiant power measurements including the ultra-violet and infra-red, but also—for standards of light and colour temperature—regular intercomparisons with six other National Laboratories. The comparative measurements are made at the Bureau International des Poids et Mesures at Sèvres near Paris, Great Britain being one of the countries subscribing under treaty to the maintenance of the Bureau which is the international authority on metrological units and standards. In accordance with present policy, test-work done within the Division is restricted to that which calls for specialised experience or equipment, but the Division retains the scientific responsibility for the regular public services offered by the Test House which now include measurements of luminous intensity and flux on all kinds of lamps, and measurements of colour temperature. To these will soon be added comparative colorimetric measurements on tubular fluorescent lamps.

Laboratory staff engaged directly in all aspects of photometry and colorimetry, but excluding radiant power measurements as such, now number about 20, and occupy some 6,000 sq. ft of laboratory space much of which, however, is taken up by necessary set pieces such as sphere photometers.

The authors are with the National Physical Laboratory, Teddington, Middlesex.

Photometry

The fundamental NPL photometric standards consist exclusively of tungsten filament lamps—two groups of intensity standards working at nominal colour temperatures of 2,042°K and 2,353°K, and two groups of flux standards at 2,353°K and 2,788°K. The full story of these standards, of their alignment with those of other countries, and of the primary standard is told in NPL Note on Applied Science No. 24 (HMSO, 1961). Recently, however, a group of intensity standards running at 2,854°K has been established. These are gasfilled lamps with grid-filaments of straight wire, rated at 30v,6A and made by the Osram G.m.b.H., Munich. With these, the intensity and colour temperature vary very little with deviation from the normal direction of view whereas with the coiled filament of the more usual type of gasfilled lamp the variations are generally prohibitive for really accurate calibrations.

For the same reason, these lamps were used in the experiments on the possibility of making absolute photometric measurements by a radiometric method, described on page 220 of *Light and Lighting*, July 1961. To dispel possible misunderstanding, it must be mentioned that the primary aim of this work is to enable *tungsten lamps* of any colour temperature to be calibrated as fundamental standards by an intrinsically simple method and without use of a material standard of light. Since at present one cannot devise a simple colour filter to match a thermopile to standard-eye response *exactly*, a correction for some residual mis-match is necessary, and to calculate this one requires to know the spectral energy distribution of the lamp. For tungsten lamps the correction can anyway be made small, while only an approximate knowledge of the spectral distribution or colour temperature suffices for calculating it quite accurately. For other types of lamp the position is not so favourable—although one would not in theory expect that the errors need exceed those associated with current methods of measuring such lamps with a photocell and filter. The low sensitivity of thermopiles could pose practical difficultes, however. The role of the thermopile is thus at present seen not as a usurper displacing the very sensitive photocell in high-precision *comparative* photometry, but as the simplest and most logical, and ultimately the most accurate *absolute* means of establishing the basic unit of luminous intensity in terms of the intensities of tungsten lamps.

In standards photometry however, the king-pin is still at the moment the high-grade vacuum photoelectric cell, combined with a rigidly fixed diffusing window and a filter to simulate standard-eye response; but two recent advances are worth notice. The first is the VB59 photocell developed by Rank Cintel from the VB39. The cathode is flat, and is more uniformly sensitive, and the internally metallised bulb with transparent conducting window forms a 'Faraday cylinder' anode enclosing it. The stability of response, with no variable electrostatic charges on bulb-walls to disturb it, is remarkably good. Secondly Jones and Sanders have shown that the electrometer valve-bridge of a photoelectric photometer ought not to be left unbalanced even for a short time, otherwise fatigue effects similar to those observed in photo-emissive cells will be provoked in the valves. These two advances, taken together, are an important step towards quicker and more accurate photometry.

A problem which often confronts the photometrist is the really precise measurement of large light-ratios, for example the transmission factor of a sector-disc attenuator of nominal ratio 1:100 or less. A novel method is being developed in which the light-ratio is converted to a time-ratio which is easy to measure with high accuracy.

Over the past year or so the photometric standards laboratory has been re-furbished and largely re-furnished, and provided with a new integrating sphere of 7 ft diameter the two halves of which are hinged to open like a book (Fig. 1). The ease of access is very convenient for general investigations, as well as maintenance of the sphere itself, while the size suits the whole of the most important range of

standard lamps—as well as tubular lamps up to the 5 ft sizes.

In the international field, the results of a recent inter-comparison are awaited. The last, in 1956, showed that the NPL unit lumen at 'gasfilled' colour was 0·7 per cent larger than the world-mean. The most recent results with the platinum primary standard, throughout the world, show an extreme spread of 1·4 per cent, with NPL differing by 0·5 per cent from the world-mean. It appears very difficult to achieve an accuracy better than ±0·5 per cent, with certainty, in the comparison of units by the exchange of groups of about six lamps, although this figure shows statistical improvement when results of a number of such operations are averaged —as indicated by the fact that two successive world-means of results with the primary standard differed by only 0·15 per cent. The problem of whether the adjustment of any one country's unit toward a world-mean (derived from exchanges of lamps) would or would not constitute a real improvement in accuracy is therefore something of a poser. The NPL has not yet in fact made such an adjustment.

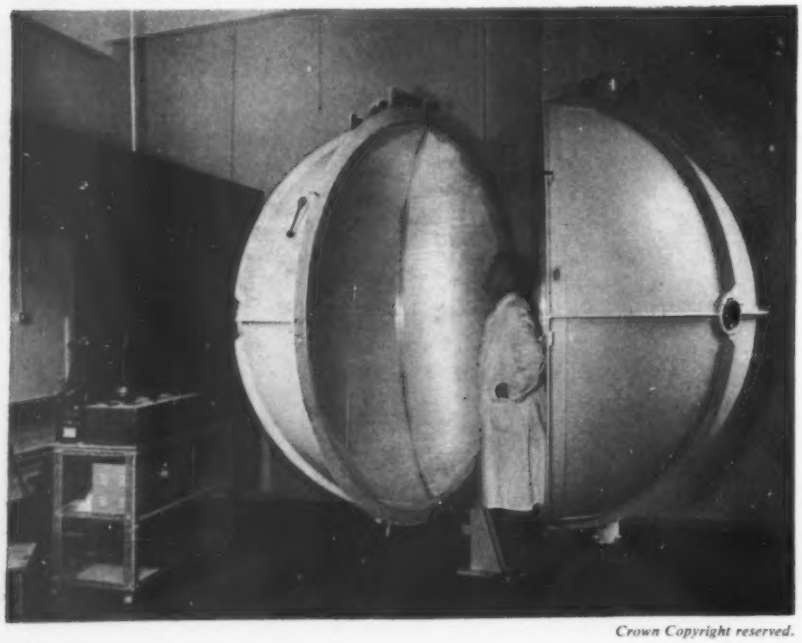
Finally, as regards photometry, two examples of the special tests still done in the Light Division of the Laboratory are the testing of signalling lamps to Ministry of Transport specification, and the measurement of the low luminances of luminescent materials.

Colorimetry and Spectrophotometry

The Light Division of the NPL maintains the official scale of colour temperature, but we shall not describe this particular work in much detail. Readers will know that the radiation spectrum of a black-body radiator, and therefore the colour of the light emitted, is a function simply of the true temperature. Because of the emissive properties peculiar to tungsten, an incandescent tungsten filament at a given true temperature emits a spectrum which, in the visible region, is very similar to that of a black-body at a definite but rather higher temperature. So, for colorimetry and many other purposes, it is handy to use a tungsten lamp as a substitute for a black-body and, forgetting all about the true filament temperature, to assign to it the corresponding higher black-body temperature, known as the colour temperature. The first step in setting up a scale of colour temperature is, in effect, finding the voltage at which a tungsten lamp must be run so that its spectrum matches that of a black-body at a known temperature. This done, the colour temperature for any other voltage can be found by comparing the two spectra of the lamp at the two voltages, spectroradiometrically.

A method and procedure for thus determining the curve connecting colour temperature with voltage and for comparing the colour temperature of one lamp with that of another has recently been evolved. Later, if the spectral measurements can be made absolute, to the rather high necessary accuracy, it will be possible to use them to determine the first point on the curve without need for comparison with a black-body. This work provides the basis for practical colorimetry, in which the specified illuminant known as Standard Illuminant A is a tungsten filament lamp working at a colour temperature of 2,854°K.

Fig. 1. This integrating sphere, of 7 ft diameter, has recently been installed in the Light Division of the National Physical Laboratory and will be used in research work directed towards improving the accuracy of measurement of luminous flux. It should be mentioned that the interior is, as yet, unpainted



Crown Copyright reserved.

Because of the rather specialised nature of colorimetry and spectrophotometry, all work in these fields is at present done in the Light Division, much of it being devoted to improvement of methods and accuracy. Tests for customers cover coloured light signals—for example ships' navigation lights—coloured filters of all kinds, welding and other protective glasses, polarising materials, fluorescent materials, paints, textiles, tiles, powders, and so forth. Of light sources examined, fluorescent lamps naturally form the large majority. Contrary to the expectation of many visitors seeking advice on the best colour-film, however, the Laboratory has had no more than a user's concern in colour reproduction systems.

The measurements fall mainly into the two classes of colour measurements or comparisons made with a colorimeter, and spectrophotometric measurements. The latter are frequently required to provide data for the computation of the trichromatic specification of a colour by the well-established procedures; but often the spectrophotometric results themselves are also of consequence. For example, welding glasses have to be tested for the proportion of radiation transmitted at certain wavelengths in the ultra-violet. So, for convenience and completeness the available spectrophotometric range extends from 0·2 to 1·0 micron. Many of the reasons for interest in the near ultra-violet and infra-red may now be considered academic; but some, like the rapid development of fluorescent materials since the second world war, and of interest in processes of fading, have stressed the importance of the whole gamut of daylight radiation from about 0·3 micron to, say, 2·5 microns. In consequence, a need has arisen for improving and extending knowledge of standards of emission such as tungsten lamps, and of reflection such as magnesium oxide, and this is one direction being taken by current research, referred to in more detail below.

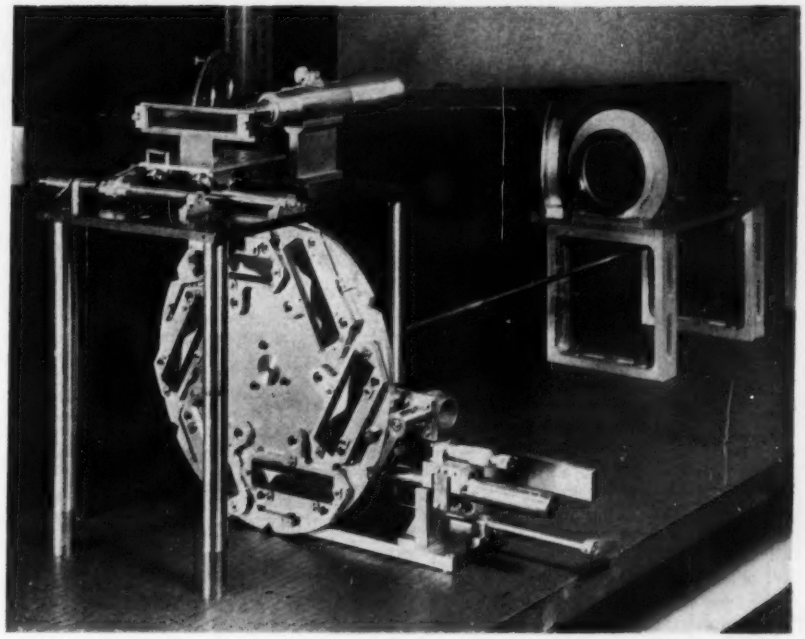
The Divisional equipment includes a Donaldson six-stimulus visual colorimeter and a commercially-made photoelectric colorimeter which, together, serve for most of the direct colorimetry. In addition, there is the Lovibond-Schofield Tintometer and a comparator developed for use in colorimetric haemoglobinometry. Two recording spectrophotometers cover the ranges 0·2 to 0·8 and 0·4 to 1·0 micron, respectively. For higher accuracy a manually operated spectrophotometer is available, while a recording spectroradiometer provides for measurements of spectral power distribution relative to that from a tungsten filament standard. These last two instruments were built in the Division using Müller-Hilger double monochromators as dispersing elements.

It is a hard fact that, thirty years after the birth of the CIE Standard Observer, none

of the instrumental methods is yet capable of measuring colour absolutely to an accuracy which competes with the best that the eye can do in distinguishing small colour differences. This is partly because of the residual uncertainties in the standards of emission and reflection already mentioned. Thus, it is not possible to guarantee the chromaticity co-ordinates of near-white fluorescent lamps, for example, to better than 1 per cent, whereas the eye can detect the equivalent, in colour, of about $\frac{1}{3}$ per cent or even less in such examples.

However, some visual instruments, like the Donaldson six-stimulus colorimeter, are almost as sensitive as the eye itself, and the better photoelectric colorimeters are even more sensitive when used purely as differential instruments, to measure colour differences between radiations which are closely similar in spectral composition. Thus, for use with the Donaldson colorimeter, with the increasing pressure for higher accuracy, as with fluorescent lamps, a system of similar standardised lamps is being gradually built up. At the same time, a study of the photoelectric spectrum-mask type of instrument has been in progress. The principle of this instrument is the now well-known one of dispersing the test-light into a spectrum where a suitably shaped mask or templet obstructs different fractions of light at different wavelengths, and then re-combining the remainder into a beam which falls on the photocell or photomultiplier. The mask is thus equivalent to a colour filter whose spectral transmission curve can be shaped as desired in order to modify the photocell spectral response, and give an overall spectral response of any desired form fairly exactly. A very sensitive differential colorimeter of this type is nearly complete, suitable for routine comparative measurements of fluorescent lamps to a relative accuracy of about one tenth per cent in x or y (Fig. 2). For such measurements, groups of selected lamps, having spectra generally similar to those of lamps to be measured, will be carefully standardised for use as reference standards. Other kinds of measurement can readily be made with this type of instrument; for example, the relative amounts of the luminous flux of a given light which are contained in a number of selected spectral bands, for the assessment of colour rendering properties. This requires simply the provision of the same number of suitably shaped masks. An important feature of this instrument provides for automatic compensation for any unsteadiness of the lamp even when it is run on a stabilised supply. This will ensure that measurements made sequentially using different masks will be correctly related to one another.

Similar compensation has lately been introduced on the recording spectroradiometer together with means for keeping fluorescent lamps in any constant ambient temperature between 20°C and 30°C during measurement. The lamps and their control gear are housed in a thermostatically controlled annexe to the spectroradiometer room (which is also at a fixed temperature) with a hole in the dividing wall for the passage of the light.



Crown Copyright reserved

Fig. 2. The templet-changing mechanism of a new templet colorimeter recently designed in the Light Division of the NPL. This instrument will be used for routine comparative colorimetry of fluorescent lamps

As already mentioned, measurements of spectral power distribution with the spectroradiometer are made by comparison with the relative power distribution of a tungsten lamp reference standard, as defined by its colour temperature (usually 2,854°K), and hitherto assumed to be unchanged by reflection at the magnesium oxide surface which serves as a secondary source to ensure filling of the aperture of the spectral instrument. The emphasis on high accuracy has led to the consideration of what small differences may exist between the spectra of various lamps all at the same nominal colour temperature. These may result from differences in emissive properties of different filaments, due to small differences in the states of their surfaces, or from the different geometric forms of different filaments giving rise to different degrees of end-cooling and of inter-reflection of light within the coils, or from envelope losses and distortions. All these, and means for reducing the effects of ageing of the reference lamps, are being investigated. Further, there is now evidence that the spectral reflectivity of magnesium oxide is not so uniform or as accurately reproducible as has been generally believed. Work has started on the absolute measurement of the spectral diffuse reflection factor with the object of resolving these uncertainties, and of replacing magnesium oxide by some other form of 'perfect diffuser' realised in terms of a more permanent and reproducible material, having in mind some extension into the ultra-violet and infra-red as mentioned above.

In similar vein, some further investigations have recently been made into the marked retro-reflective properties which have been found to be exhibited by smoked magnesium oxide surfaces when observed in directions near to the direction of incidence. This phenomenon was, in fact, first observed during the last war in a study, in the Division, of the scattering of short-wave radar pulses by a choppy sea, using a scaled-down optical analogue in which magnesium oxide represented the surface of the sea; but it may well have remained forgotten but for more recent observations made in the course of measurements on more familiar types of retro-reflector.

Vision

Turning now to the subject of vision, one notes particularly the recent re-determination, in the Light Division, of the colour-matching functions of the eye, complying with a recommendation of the CIE that the 1931 data should be re-examined in view of more recently reported discrepancies. Observations have been made both with the 2° field of the original work, and also a 10° field. Differences between the two sets of observations have led to field trials by various workers with the object of providing a basis on which the most appropriate functions for given applications can be chosen. These trials, in their

turn, have revealed inconsistencies, and the most recent work in the Division indicates that for large centrally fixated fields the shape of the matching functions depends on the saturation of the field. The work is now directed toward establishing regions of saturation applicable to given functions, personal variations and, if possible, corrections for going from high to low saturation.

The colour-rendering properties of fluorescent lamps have also claimed much attention in recent years. The method of attack has been to determine, by observation of common objects such as food and the human complexion, the degrees of variation that can be tolerated in terms of deliberate measured changes in the spectral composition of the illuminant. The criterion was the just noticeable difference in object-colour, estimated by memory, by comparison with the appearance under some standard type of illuminant. Illuminant changes were assessed in terms of the luminances in a set of contiguous spectral bands chosen, from preliminary experiments, to have roughly equal importance in the rendering of colour. The results make possible the prediction of the colour-rendering performance of an illuminant from knowledge of its spectral energy distribution. They appear quite suitable as a basis for specifications and as a guide to lighting engineers in choosing lamps most appropriate for particular purposes.

Conclusion

In conclusion, it is not inappropriate to revert again to the essential importance, to the Laboratory and those whom it serves, of maintaining close co-ordination and alignment with other national laboratories. Much of this work goes unnoticed, but it nevertheless absorbs much of the modest total effort available to the above subjects in the Light Division of the Laboratory. In colorimetry, regular intercomparisons are not yet such a well-established feature as in photometry, but a series of international comparative measurements now drawing to a conclusion includes colorimetric ones, and the results are awaited, by the Laboratory and industry alike, with great interest.

The work referred to above forms part of the research programme of the National Physical Laboratory, and the article is published by permission of the Director of the Laboratory.

Apparent Brightness

The measure of what we see

By R. G. HOPKINSON

PhD, MIEE, FIES, FRPS

Some problems in the lighting of buildings cannot be handled by traditional methods based on calculations of illumination level. Where it is required to design for the final appearance of the interior, it may be necessary to work to a scale of apparent brightness, this term being a function of the adaptation conditions—in other words, the lightness or darkness of the general surroundings. The purpose of this article is to show, by a simple example, how apparent brightness can be put to the service of the lighting engineer, although it will be some time before apparent brightness can be made the basis of everyday lighting technology.

THE CLASSIC DEMONSTRATION of apparent brightness is a room seen through an open door from outside on a bright day. The room seems dark, so dark in fact that little detail can be distinguished. If we enter the room, and give our eyes a little time to adapt, everything now seems brighter. The mere act of going into the room cannot in any way have affected the photometric brightness inside, but the adaptation of the eye has changed the apparent brightness.

A rather more subtle example would be obtained by comparing objects seen on a lighted street at night with the same objects seen by day, using a photometer as a measure. A well-lit, white road-direction sign might have a luminance (photometric brightness) of the order of 5 to 10 ft-L and, when seen at night, would stand out brilliantly against the rest of the landscape, which, on a built-up road with Group A lighting might have an average luminance of not more than 0·5 ft-L. This same sign when seen by day would just about be able to distinguish itself from its surroundings by virtue of its whiteness but it would by no means be the brilliant object that it is by night. Yet its luminance could well be greater than 1,000 ft-L, more than 100 times its night-time value. Its luminance would thus give no idea of its apparent brightness.

It follows that any lighting engineer who has to deal with the appearance of things must have some understanding of the concept of apparent brightness, even if only of a qualitative kind. The notion of apparent brightness did, in fact, arise in the study of street lighting, where visual observation led to grave doubts of the usefulness of the ordinary luminance scale. In order to say of what value a road surface of 1 ft-L *luminance* would be in revealing traffic, it was necessary to establish subjectively what 1 ft-L looked like in a lighted street; in other words, it was necessary to determine its apparent brightness.

Apparent brightness is a measure of adaptation and contrast, and is easier to describe visually than in writing. Analogies are always misleading and I paraphrase Professor S. S. Stevens, therefore, with some reservations: 'If your annual salary is £500, and your standard of living suitably adapted, a gift of £10 is a sufficient addition to your income with respect to your adaptation level to make you very pleased to receive it. If, however, your brother's annual salary is £24,000 and he is adapted to this much higher standard of living, he will barely notice a gift of £10. Perhaps £500 or even £1,000 would be necessary to create as much pleasure for him as the £10 gift gives you.' Some economists have in fact developed theories of wealth and welfare from considerations of this kind, not only in the obvious but vague way suggested here, but precise and quantitative. What it amounts to is simply that you appreciate what you are given in terms of what you already have. By analogy, you appreciate any brightness in your visual field in terms of what is already there.

Dr Hopkinson is in charge of lighting research at the Building Research Station.

Consequently, if the lighting engineer has an assignment to light a supermarket so that it satisfies the architect's desire that it should look 'as bright as day', it is not necessary to supply the illumination of 10,000 lm/ft² which the sun outdoors would provide. He would first determine the *apparent brightness* which will make the supermarket as bright as day and then supply the same apparent brightness by artificial lighting at a much lower level of illumination, taking advantage of the eye to adapt. But the engineer would have to complete the design of the installation in terms of luminance, intensity and illumination. Apparent brightness serves merely as a go-between; the actual design must be carried out in terms of real, measurable physical energy.

Interpretation of requirements

The most difficult part of the job of achieving the architect's desires lies in the interpretation of his requirements. There are very few architects who can be precise in describing the lighting effects which they want to achieve. There is no doubt that the simplest way of finding what is in the architect's mind is to set up a scale model of the proposed building with as much detail as possible and to make adjustments until the architect is satisfied. However, once this is done, there is then very little need for any apparent brightness calculations.

An alternative, but less satisfactory, procedure is to ask the architect to show some other scenes and to describe his requirements in terms of those. An architect designing a concert hall might, for example, ask the lighting engineer to arrange that the concert platform, as seen by the audience, should 'stand out boldly' in brightness over the rest of the interior, whilst the walls and ceiling of the auditorium should be 'unobtrusive'. He might be able to show the lighting engineer some other scene in which part of it 'stands out' to the degree he has in mind for the orchestra, or where some part of it is 'unobtrusive' in the way he wishes for the auditorium. The procedure would then be for the lighting engineer to measure the *luminance* (with a photometer) of the relevant part of the scene and also measure the general adaptation level at the same time—this would be taken to be numerically equal, expressed in ft-Lamberts, to the illumination expressed in lm/ft² on the observer's eye when looking at the scene. Then by studying a set of apparent brightness scales the lighting engineer would be able to establish what should be the apparent brightnesses of the 'unobtrusive' ceiling and 'dominant' stage.

The next step would be to reproduce these apparent brightnesses in the final design of the interior. There are several methods by which this may be done. One method would be first to determine, from some over-riding consideration, what the general level of illumination in the interior should be, and in a concert hall this might well be determined by the difficulty of reading music on an orchestra stand. A level of illumination of 30 lm/ft², as recommended by the IES Code, is indicated, which, in itself would provide a sufficient starting point. Such an illumination might produce an average luminance of concert platform and orchestra, as seen by the audience, of the order of 10 ft-L. It would therefore be necessary to know what adaptation level would give the required apparent brightness when the actual luminance is 10 ft-L. If this procedure is adopted, for the sake of example, the steps of the argument are then:

1 Determine the necessary apparent brightness of the interior.

2 Select a starting-off point for the calculations (which might be the necessary level of illumination on the working plane). From this determine the photometric luminance of the starting point.

3 Relate this luminance to the required apparent brightness of the same area and find the necessary adaptation conditions for this relation to hold good.

4 Find on the appropriate adaptation curve the necessary values of luminance which will give the required apparent brightnesses of the other selected areas.

5 Calculate the distribution of light to enable these luminances to be realised.

In this last stage, of course, lies all the skill of the illuminating engineer. Some interiors will be handled by relatively simple techniques; in others, detailed methods of brightness design, such as those put forward by Waldram, would be necessary. It is not the purpose of this short article to discuss the circumstances in which methods of different complexity must be used.

Value of apparent brightness

Apparent brightness is, in fact, just one of the tools which the lighting engineer now has at his disposal. It is a particularly useful tool when comparisons have to be made between the visual impact of a scene under one adaptation condition and a scene under another. The first instance in which apparent brightness techniques are known to have been used in interior lighting design was the post-war relighting of a rebuilt section of the National Gallery, where the requirement was to realise certain concepts of the architect for brightness emphasis on the pictures. It would however, have been an even more interesting problem to light the pictures to have the same visual effect by day and by night because this would indeed have enabled the full visual brightness considerations to be brought into the calculations.

Apparent brightness serves to enable us to create a prescribed environment, provided that the prescription can be made sufficiently precise. If this is not possible, it is doubtful whether any advantage is to be gained by complicating the design procedure by bringing in apparent brightness at all.

The concept of apparent brightness has its limitations, one of the most serious being that it will not reveal in advance exactly how the elements of a scene will appear, because of the phenomenon of 'brightness constancy'. An example of brightness constancy is the way in which a bright ceiling lit by daylight from a side window appears white all over its entire surface even though its luminance adjacent to the window may be five times that in the remote part of the room. In fact, it looks almost uniformly bright and white until the observer studies it with greater thought. This is because the eye can differentiate between a light surface which is poorly illuminated and a dark surface which is brightly lit; in the lighting engineer's jargon, this means that the eye can distinguish in the brightness of surfaces the separate components of reflectance and incident illumination. This is true only when the source of light and its position relative to the surface being viewed can be seen. If a deliberate attempt is made to deceive the eye as to the origin of the light, the ability to make this distinction between reflectance and illumination is lost.

Further warning

One further word of warning is necessary. The terms of reference for writing this article were 'to explain apparent brightness in such terms that the average lighting engineer would understand its significance and value' and to this end an example has been chosen to avoid as many difficulties as possible. But in fact the application of apparent brightness concept to lighting design is not simple, at least not at the moment. For one thing, there are as yet no universally reliable apparent brightness scales and the engineer, if he sets out to apply the steps shown in the example to another installation, may well run into inconsistencies which he cannot resolve. Work is in progress, particularly at the Northampton College of Advanced Technology, to derive more reliable scales than exist at the moment, but it would be deceiving the reader to leave him with the impression that everything is ready for him to take up the use of apparent brightness in his everyday work. This can be said in spite of the work of, among others, J. M. Waldram and R. O. Phillips, who have given us methods of computing brightness and flux distribution in interiors; Waldram is, of course, using apparent brightness in his own lighting design.

This is as far as this short article can go in trying to explain the intricacies of the concept and use of apparent brightness. If it has raised as many questions as it set out to answer, its purpose will have been achieved. This purpose was to set the lighting engineer thinking about the possibilities of this new tool of his profession.

The article continues on the next page with a practical example.

Apparent Brightness (continued)

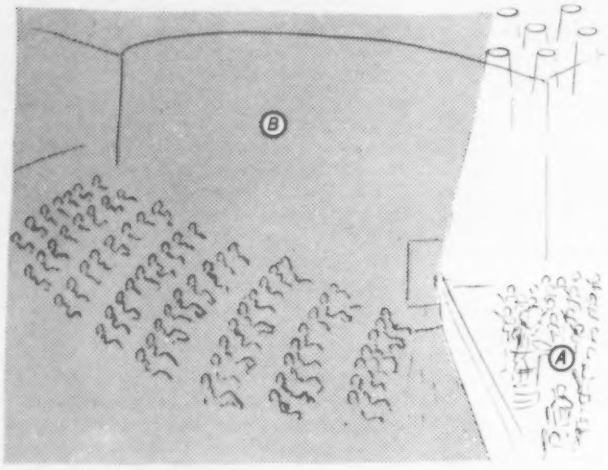


Fig. 1

Fig. 2

Fig. 3

EXAMPLE

It is required to light a concert hall to satisfy the architect's demand that the orchestra should stand out boldly and that the walls of the auditorium should be 'unobtrusive'.

A rough idea of the difference in brightness between the concert platform and auditorium is shown in areas A and B of Fig. 1 but as this is obviously of no design value, more specific guidance must be obtained from the architect. The architect is invited to inspect some other scenes in order to find areas which have the attributes for which he is asking. As a result of this inspection, he says that the area shown as C on Fig. 2 has just the attribute of bold brightness he wants for the concert platform and area D on Fig. 3 is just what he needs for the walls of the auditorium.

Procedure

1 Measure the adaptation levels of the scenes of Figs. 2 and 3. One way is to measure the illumination, in lm ft^2, at the observer's eye and to assume that the adaptation level is numerically equal to this, but expressed in ft-L; another method is to take several readings of a restricted-field brightness meter, such as a Weston exposure meter, and determine an average of the values obtained. It is assumed that the adaptation levels for Figs. 2 and 3 are 30 and 10 ft-L respectively.

2 Measure the local brightness of area C of the first scene and area D in the second scene. It is assumed that they are 120 and 3 ft-L, respectively.

3 Refer to a set of apparent brightness scales such as those reproduced in Fig. 4. On the adaptation curve for 30 ft-L (the adaptation level for Fig. 2), find the point of intersection with the luminance of 120 ft-L (point X) and project orthagonally on to the ordinate axis to find the apparent brightness of the area C when seen in the surroundings of Fig. 2; this gives an apparent brightness of 10, as shown. In the same way, using the adaptation curve for 10 ft-L, find the point of intersection with the luminance of 3 ft-L (point Y) and hence the apparent brightness of area D when seen in surroundings of Fig. 3; as shown, it is 1. It has now been established, albeit by a necessarily tedious process, that the architect intended, but could not specify sufficiently precisely, that the brightness attributes of the concert platform and auditorium walls are equivalent to apparent brightnesses of 10 and 1 respectively.

4 Take, as a convenient starting point for the design, the need to provide an illumina-

Fig. 1. Rough sketch of the interior of the imaginary concert hall of the author's example in which the architect has specified that the orchestra platform should 'stand out boldly' and the walls and other surfaces of the auditorium should be 'unobtrusive.' Asked to specify the brightnesses more exactly, the architect says that the area of C in Fig. 2 has the brightness he wants for the concert platform and the area D in Fig. 3 has the desired unobtrusiveness for the auditorium

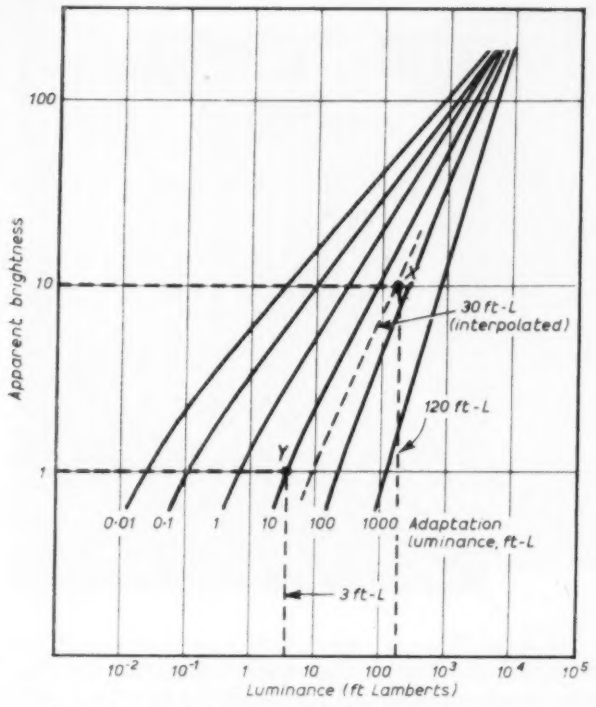


Fig. 4. Curves relating apparent brightness to luminance at various adaption levels. They show that the apparent brightness of area C of Fig. 2 is 10 when its luminance is 120 ft-L in an adaptation luminance of 30 ft-L and the apparent brightness of area D of Fig. 3 is 1 in an adaptation level of 10 ft-L when its luminance is 3 ft-L

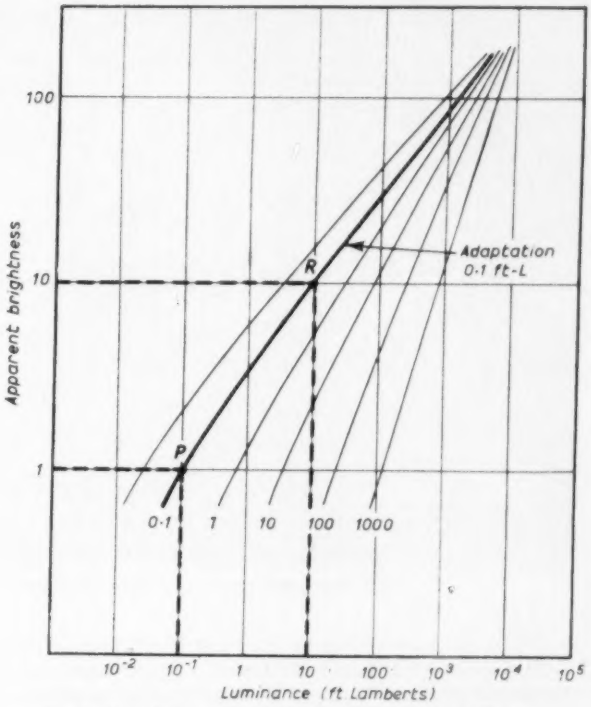


Fig. 5. Use of the same apparent brightness scales as Fig. 4 to deduce luminances of surfaces knowing their apparent brightnesses. Area C, with an apparent brightness of 10 has a luminance of 10 ft-L in an adaptation luminance of 0·1 ft-L and area D has a luminance of 0·1 ft-L at the same adaptation level. The scales are reproduced with acknowledgment to 'Illuminating Engineering', being taken from an article by the author published in the April 1957 issue of vol. 52 of that journal

tion of 30 lm ft² on the concert platform (as recommended in the IES Code) so that musicians can adequately read their music.

5 Estimate, or measure, the average reflectances of the orchestra, woodwork of the podium, pink faces and black clothes of the performers, white music sheets and so on; assume that this averages 33 per cent. In an illumination of 30 lm/ft², the luminance of the concert platform and orchestra will then be $0{\cdot}33 \times 30$, or 10 ft-L.

6 Find the adaption level in which a luminance of 10 ft-L has an apparent brightness of 10 (the specified level originally indicated by C in Fig. 2). This is done by finding on Fig. 5 (identical to Fig. 4 but reproduced separately for clarity) the point of intersection of an apparent brightness of 10 with a luminance of 10 ft-L; the adaptation curve on which this point (R) lies is the adaptation level in the concert hall. It is 0·1 ft-L.

7 Having established the adaptation level it is now necessary to determine the luminance of the auditorium walls, to give them an apparent brightness of 1 as required by the original specification (area D in Fig. 3). On Fig. 5, find the point of intersection of an apparent brightness of 1 with the adaptation curve of 0·1 ft-L; this point (P) gives a luminance of 0·1 ft-L for the walls.

8 We have now established the design requirements in terms of luminances; the rest is straightforward illuminating engineering and therefore beyond the scope of this article. Waldram's methods provide a logical series of calculations to be followed to arrive at the required lighting installation.

Simplification

Sometimes, as in the present example, if there is no need to adopt the precision necessary to meet regulations or a specification, the calculations can be simplified considerably or as a result of experience and inspection. In this case, experience would suggest that by a suitable choice of reflectances for walls and other auditorium surfaces, the reflected light from the platform alone will impart the required apparent brightness to the walls. This can be confirmed numerically.

Proceeding by the split-flux method (Hopkinson, LIGHT AND LIGHTING, **48**, 315, September 1955), suppose the area of the concert platform is one-third the area of the entire concert hall floor and that the height and width of the hall are, respectively, one-third and two-thirds the length. The total area of the room's surfaces can then be taken, for the purposes of the calculation, as 11 A ft², where A is the area of the concert platform.

Since the illumination on the platform is, by specification, to be 30 lm/ft², the incident flux on the platform will be

$$F = 30 \text{ A Lumens}$$

Since the reflectance of the orchestra is 33 per cent, the first reflected flux will be

$$F' = 30 \text{ A} \cdot 33/100 = 10 \text{ A}$$

The indirect illumination in the room will be

$$E' = F'/11 \text{ A } (1-R) \text{ lm/ft}^2$$

where R is the average reflectance of the hall.

As the walls and other surfaces are to have a luminance of 0·1 ft-L in order to give the necessary apparent brightness (and assuming, for simplicity, that the reflectance of the walls is the average for the entire interior), it follows that

$$E'R = 0{\cdot}1, \text{ hence } E' = 1/10\,R$$

Therefore,

$$\frac{F'}{11 \text{ A } (1-R)} = \frac{1}{10\,R}$$

$$\frac{10 \text{ A}}{11 \text{ A } (1-R)} = \frac{1}{10\,R}$$

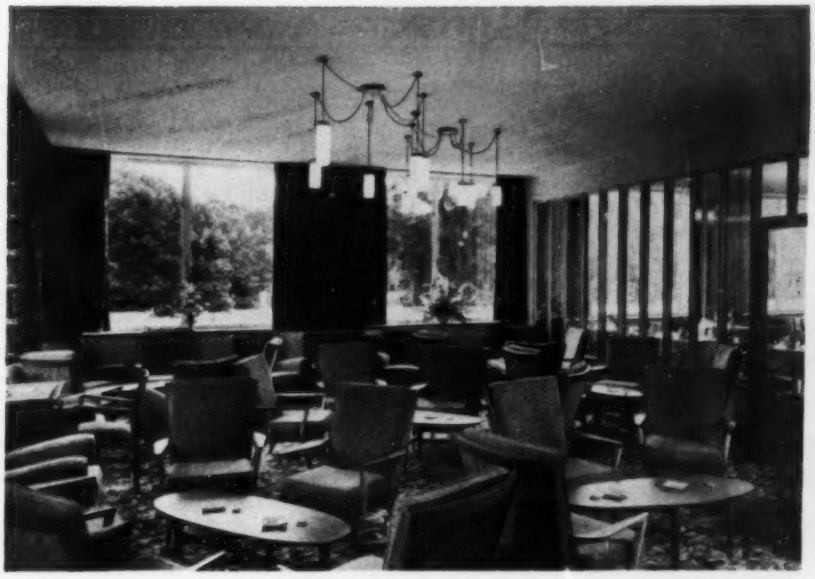
from which $R = 0{\cdot}1$ approximately.

The calculation confirms that, if the walls can be decorated to a low reflectance of approximately 10 per cent, the interreflected light alone will provide the necessary apparent brightness.

New Hotel Overlooking Hyde Park

Architects: Lam, Biel and Partners; electrical installation: Electengs Ltd; lighting fittings: Atlas Lighting Ltd, Courtney, Pope (Electrical) Ltd, Falk, Stadelmann and Co Ltd, Philips Electrical Ltd

A TEN-STOREY building on a corner site overlooking the north side of Hyde Park, the Hertford Hotel is the first hotel to be completed in London since the Carlton Tower opened in January (see *Light and Lighting*, March 1961). Built by the same contractors, Sir Robert McAlpine and Sons, it is operated by Trust Houses, being the latest addition to their chain of 225 hotels throughout the British Isles. The ground floor of the building is occupied mainly by a petrol filling station and there is a basement garage. The reception desk and public rooms are on the first floor. These rooms comprise lounge, restaurant and a small bar intended mainly for residents, while the 77 bedrooms are on the eight floors above. Each room has a private bathroom (most with shower as well as bath), telephone, radio, and connections for television; most are arranged as studio rooms, with beds placed against the walls for daytime use as settees; yet prices are moderate for a new hotel in London—from 80*s.* to 85*s.* for a double or twin-bedded room. The building is, of course, centrally heated and a visitor's laundry is provided (in addition to laundry service), equipped with washing machine, airer and iron. Décor aims at a friendly, rather than opulent, atmosphere. The public rooms are not large; ceilings are low; and furniture is domestic in character. There are fitted carpets throughout; acoustic ceilings in the restaurant and lounge; and



Bedroom windows of the ten-storey hotel (left) have horizontally-pivotted opening lights. The restaurant (opposite page) is lit mainly by 60-watt spotlights part recessed into the sloping acoustic ceiling; the lounge (right) by a cluster of opal-glass cylinders housing 60-watt lamps; and the bar (bottom right) by crystal glass fittings from the Atlas 'Chelsea' range. Bedrooms (bottom left) have special fittings for general lighting, to which adjustable reading lights are attached.

a strongly-textured woven fabric has been used for all upholstery, for the tailored bedcovers and for the padded bed-heads.

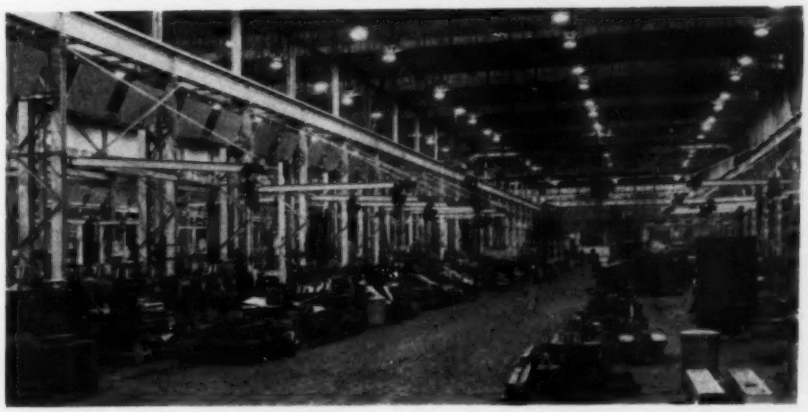
Lighting aims at reinforcing the friendly atmosphere. In the restaurant, fluorescent lamps concealed above the edge of the sloping acoustic-tile ceiling bathe the plain curtains with light, while into this ceiling rows of spotlights, including four directed on to the end-wall mural by Ian Eadie, are part recessed. In the lounge a cluster of opal-glass cylinders hands from the centre of the ceiling, though these are to be replaced later by more decorative glassware; while in the bar subdued lighting is provided by pendants from the Atlas 'Chelsea' range (decorative glass lit by tungsten lamps concealed by black metal sleeving), those over the counter being supplemented by spotlights recessed into the soffit. In the bedrooms, a specially-designed fitting stands on each bedside table. Topped by a glass lantern with a dish-shaped reflector above (for general lighting), this fitting has, attached to its vertical support, an adjustable conical shade housing a second 40-w lamp (for reading in bed). In larger rooms a fitting of similar design is fixed to the wall adjacent to the dressing table, while the lobby is lit by a spotlight recessed into the ceiling. Bedroom windows, 8 ft wide on the main façade, are fitted with single-pane, horizontally-pivotted opening lights.

LIGHTING INSTALLATIONS

The pictures left and below illustrate two contrasting approaches to the lighting of a printing works. Left is the new composing room at London Counties Newspapers, where a luminous ceiling of Lumenated 'Westminster' pvc panels was chosen to provide a high level of illumination with minimum reflected glare from type surfaces. Architects: Harold Baily, Sutcliffe and Associates; electrical contractors: Sandilands (Electric) Ltd; lighting: Lumenated Ceilings Ltd. Below shows the binding room at Burrup Mathieson's where 4 in. square trunking has been installed to house the wiring for the machines and to carry the fluorescent trunking and slotted reflector fittings. Architect: E. J. Epril; electrical contractors: Engineering Services Installations Ltd.; lighting: Atlas Lighting Ltd.

Left shows the new electronic equipment factory at Rochford, Essex, of E. K. Cole Ltd, which has been equipped throughout with fittings designed by their associate company Ekco-Ensign. More than 300 'Essex' fittings have been used, of the slotted-reflector type, for twin 8 ft white lamps. The fittings are mounted 11 ft apart on runs of continuous trunking spaced 20 ft apart, the mounting height being 13 ft 6 in. Illumination is between 25 and 30 lm/ft².

INDUSTRIAL



On the right is a view of the new car bodies' press shop at Swindon of the Pressed Steel Co and below shows the new extensions to the Longclose Engineering Co's works at Leeds, both of which have been lighted by Philips. The former makes use of 1,000 W fluorescent-bulb mercury lamps (MBF/U) in contrasting fittings spaced 25 ft apart at a mounting height of 35 ft, to give an illumination at job level of about 25 lm/ft². The latter employs 8 ft, 125 W tubular fluorescent lamps in twin-lamp slotted reflector fittings, with, locally, single 5 ft, 80 W reflector fittings, by which the illumination is increased from the general level of 25 lm/ft² to between 40 and 50 lm/ft² in work areas. Architects: Charlton Crowther; electrical installation: R. E. Winder Ltd.

Near right, ring frame in one of three cotton mills of Fine Spinners and Doublers Ltd which have been relighted. Efficient lighting is essential, to ensure that even the finest yarn can be seen; slotted reflector fittings are used, with single 5 ft, 80 W, 3,600°K white lamps. Both mounting height and spacing vary between 8 ft 6 in. and 10 ft 6 in., having been dictated by the building construction and humidifier system; illumination is 25 ft lm/ft². Electrical contractor: James Lee Ltd; lighting, AEI Lamp and Lighting Co Ltd. Far right, new laboratories of the Wool Industry's Research Association. The major part of the installation comprises 5 ft, 80 W slotted reflector fittings, although in various air-conditioned rooms, corrosion-proof and dust-proof fittings are used and elsewhere, corrosion-resistant fittings of anodised aluminium were required. Architect: A. V. Montague; electrical contractors: Shaw, Dale and Co Ltd; lighting: Crompton Parkinson Ltd.

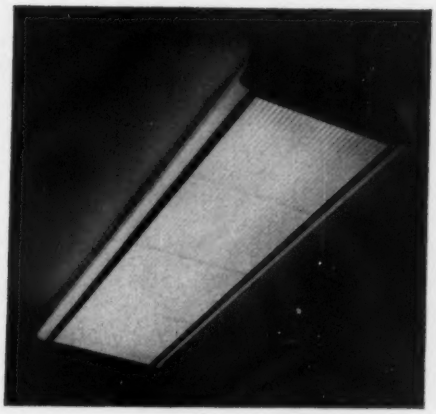
INSTALLATIONS

Left shows the new showroom of Byatts of Fenton Ltd where AEI and Isora have co-operated in providing a luminous ceiling with a total area of 3,300 ft². The ceiling comprises areas of ten translucent daylight blue Isora panels bordered by similar panels of black and it conceals an installation of 102 AEI twin-lamp batten fittings using 5 ft, 80w, 3,500°K white tubes; the illumination achieved is 60 lm/ft². For the showroom windows, 44 AEI 150w recessed ceiling fittings have been installed, concealed in Hackman board. Architect: Alwyn P. Lovatt; installation: Byatt's electrical department; lighting: AEI Lamp and Lighting Co Ltd, Isora Illuminated Ceilings Ltd.

Another use of luminous ceiling panels is shown right, which depicts the new showroom of Stour Valley Trucks Ltd. The lighting comprises 40 standard 'Brite-Glo' ceiling panels of 6 ft by 4 ft installed in the pattern shown in a suspended ceiling. The ceiling conceals twin-lamp fittings using 5 ft, 80w warm-white lamps giving an illumination of 25 lm/ft². Architect: R. H. Whitehouse; contractors: Newey and Eyre; lighting: Courtney, Pope (Electrical) Ltd.

Our third showroom to use luminous ceilings is that of Humber Ltd at Ryton-on-Dunsmore. The lighting is effected by warm-white fluorescent lamps concealed above 4,400 ft² of 'Westminster' ceiling of panels of lightweight p.v.c., giving an illumination of 85 lm/ft². The decor is stated as having been chosen to offset any tendency to glare which might result from lighting of this intensity; concave mahogany panelling and marble on the walls, a black leather covering on the pillars, a matt black infilling around the luminous panels and a neutral coloured floor are said to contribute to a clean but soft appearance. Architects: Hurley Robinson and Son; interior decoration consultants: O. B. Waller Ltd; main contractors: Garlicks Ltd; lighting: Lumenated Ceilings Ltd.

Left shows an installation of specially designed twin-lamp fluorescent fittings with 'Paragrid-Tile' diffusers and opal 'Perspex' sides in the main drawing office of the Power Gas Corporation's new building at Portland Place. Although this is a general lighting scheme, giving an illumination of 75 lm/ft², each draughtsman has control of the fitting immediately above him by means of a cord-operated switch mounted on the spacer strip between each fitting.
Below shows a close-up of an individual fitting of this type. Lighting: Harris and Sheldon (Electrical) Ltd in collaboration with W. F. Hunt, the Corporation's electrical engineer; electrical contractors: Phoenix Electric Ltd.



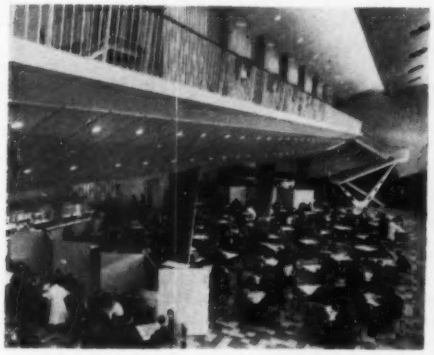
Well-diffused lighting at an illumination of about 65 lm/ft² has been achieved in this drawing office using ceiling-mounted 'Sky-Line' fittings. The shallowness of the fitting in combination with its careful control of light is claimed to provide a good solution to achieving an illumination of this order without glare, despite a ceiling height of only 8 ft 6 in. Lighting: Benjamin Electric Ltd.

One of the drawing offices in British European Airways' new five-storey building at London Airport. The illumination throughout the building is of the order of 35 lm/ft² and more than 1,000 4 ft and 5 ft fittings have been installed. This drawing office uses twin-lamp diffuser fittings mounted at a height of 9 ft at 6 ft spacing; each row contains 20 fittings. Consulting engineers: Barlow, Leslie and Coombes; electrical contractors: Rashleigh Phipps and Co Ltd; lighting: AEI Lamp and Lighting Co Ltd.

INSTALLATIONS

Left and below show views of the banking hall of Coutts and Co in Lombard Street. The main artificial lighting is incorporated in a special laylight in the form of three parallel lines of rectangular opal 'Perspex' panels alternating with louvered ventilation openings, with fluorescent fittings mounted above the panels. Separating the three rows are panels of prismatic glass which conceal a lantern light through which daylight is transmitted. Suspended on silver anodised aluminium chains in the arches over the counter positions are stainless steel troughs housing pairs of fluorescent lamps lighting both downwards and upwards, whilst the hall itself is lighted from filament lamps deeply recessed in the ceiling vaults, the fittings having internal surfaces of concentric rings for minimum reflection. Architects: Brett, Boyd and Bosanquet; contractors: Trollope and Colls; lighting: Courtney Pope (Electrical) Ltd.

One of London's new landmarks, the Church of Jesus Christ of Latter Day Saints in Kensington features a slender spire, clad in gold-leaf, 2 ft wide at its base on the side of the tower, more than 70 ft high and rising 124 ft above ground level. The whole of the front of the spire is illuminated by five Atlas 'DEW' 150 W narrow-angle low voltage weatherproof projectors sited on the roof of the entrance canopy below the base of the spire. The two sides of the spire projecting 40 ft above the tower roof are lighted from four 'AFP' 500 W general purpose floodlighting lanterns. Lighting for the Cultural Hall and the chapel itself is dimmer controlled. Architects: T. P. Bennett and Sons; lighting: Atlas Lighting Ltd, George Forrest and Sons Ltd.



Illustrations on this page are of the new Glazebrook Hall at the National Physical Laboratory, created out of the Duplex Wind Tunnel Building, and providing in one centrally sited building a fully-equipped lecture theatre seating 384, a conference room and a reading room, all on the first floor, and on the ground floor an assembly area and restaurant with both waitress and cafeteria service.
To take full advantage of the height of the existing building, a new first floor was introduced at approximately 21 ft above ground level; it extends over part of the building, thus leaving a well running the full length and height to import a sense of space and lightness.
The lecture room, lighted from a louvered luminous ceiling with cold-cathode lamps, is equipped with a variety of projection and stage lighting equipment, including a Belshazzar by which his handwriting and diagrams are projected on to the screen. Both stage and auditorium lighting may be controlled by the lecturer or by the projectionists.

FRONT COVER: Our cover illustration shows the new Gala Baths of Walsall Corporation, where the lighting was required not only to provide good seeing conditions but also to enhance the appearance of an interior already of intrinsic architectural merit. The completed scheme is based on the use of nearly 100 Holophane circular 'Lentilite' prismatic glass fittings with single 300 w tungsten lamps and recessed in the ceiling at heights from 34 to 36 ft.
Lamp and reflector assemblies are offset in relation to the lens glass to counter the 11° rake of the ceiling, so that the light is directed vertically downwards; the illumination over the pool is 15-16 lm/ft². For the spectators' area, the lighting is fluorescent, using 8 ft lamps, and the illumination 6 lm/ft². Consultants: Hoare, Lee and Partners; electrical contractors: Birch, Evans and Jellings Ltd; lighting: Holophane Ltd.

LIGHTING ABSTRACTS

OPTICS AND PHOTOMETRY

535.2

1044. IES guide for measurement of photometric brightness (luminance).

Illum. Engng., **56,** 457–462 (July 1961).

Prepared by the Measurement of Photometric Brightness Sub-Committee of the American IES, this guide defines the photometric concept concerned and then discusses the visual conditions influencing its measurement. Three types of visual brightness meter, the Luckiesh-Taylor, Macbeth and SEI instruments, are briefly described, as also are three types of photoelectric meter (the barrier-layer cell, photoelectric tube and Spectra brightness spot meters). Advice is given on the techniques to be employed when measuring the luminances of light sources, lighting fittings and reflecting or transmitting surfaces. In all cases, physical measurements, where practical, should be made in preference to visual measurements, using colour-corrected photoreceptors. P. P.

628.931

1045. Photographic representation of luminance distributions.

R. M. CALLENDER, *Lichttechnik*, **13,** 403–404 (*August* 1961). *In German*

Following the description by H. Greif of a method of obtaining a picture of a lighting installation with well-defined contours of equal luminance (see Abstract 974, June 1961) the author gives an account of a similar method applied to street lighting. He describes also a method of drawing such contours on an ordinary photograph. A supplementary note by H. Greif compares the advantages and disadvantages of the various methods that can be used. J. W. T. W.

1046. Photometry of coloured intermittent lights. 535.247

D. FÖRSTE and H. WILLENBERG, *Lichttechnik*, **13,** 455–456 (*September* 1961). *In German.*

Describes apparatus used at the P.T.B. in Germany for testing coloured signalling lights, mainly blue or yellow, which flash two to six times per second. The light from the test lamp is reflected from a plane mirror and falls on a convex lens so that an image of the source is formed within the aperture of an opaque diaphragm. From there the light diverges again and falls on a multiplier photocell. A substitution method is used, a comparison lamp burning steadily behind a sector disc taking the place of the flashing light. The calibration of the photocell is checked periodically with a local 'control' lamp and visual photometer. The reproducibility is 3 per cent and the estimated accuracy 7 per cent. J. W. T. W.

LAMPS AND FITTINGS

1047. Light source with long-duration flash. 621.3274

S. B. GIBSON and S. M. SEGAL, *Illum. Engng.*, **56,** 449–454. (*July* 1961).

Whereas flashing light sources of high intensity with only comparatively short flash durations (up to one millisecond) have been available for some time, it is only recently that sources of comparable light output with flash durations in the range 0·1 – 1·0 seconds have been developed. The essential component of the new source is a xenon-arc lamp operating inside a searchlight barrel. An electro-mechanical timing control device allows the selection of any flash duration in the working range with lamp operating currents varying between 40 and 250 amps. Details are given of photometric and radiometric characteristics of the discharge arc, and information on the photometric equipment and high-speed photographs used to obtain these data. P. P.

1048. Effect of lighting fittings on utilisation factor. 628.93

H.-J. HENTSCHEL and P. UNHAVAITHAYA, *Lichttechnik*, **13,** 405–410 (*August* 1961). *In German.*

The inter-reflection conditions in a lighted room are disturbed to some extent by the presence of the lighting fittings, just as the conditions in an integrating sphere are upset by the presence of the source. The authors have studied this effect in a model room by measuring the illumination on the floor, with scale models of typical lighting fittings (without lamps) present and removed. The light was provided, in one set of experiments by a luminous ceiling whose reflection factor was equal to that of an opaque ceiling, in another set by a luminous wall similarly matched in reflection factor with the other walls. From the results obtained it is concluded that the effect of the fittings is negligible in direct lighting but may well be over 10 per cent for indirect lighting. The measurements were made with a photocell, uncorrected for cosine error on account of the scale reduction in the model. J. W. T. W.

1049. Aperture lamps, applied. 621.327.5

S. C. PEEK, *Illum. Engng.*, **56,** 340–343 (*May* 1961).

Fluorescent lamps similar to the reflector-coated type but having an aperture of only 30° to 60°, when fitted in appropriately designed reflectors, can be used to produce a high illumination at a remote point with a narrow vertical distribution and sharp cut-off and a wide lateral distribution. Applications of these aperture lamps to horizontal surface lighting, involving low and medium mounting lights, and to vertical surface lighting are given. For edge lighting of plastic signs, no auxiliary reflector or optical system is required. P. P.

LIGHTING

628.971

1050. Report on the Sixth International Conference on Lighthouses and Other Aids to Navigation.

C. F. PEISTRUP, *Illum. Engng.*, **56,** 314–316 (*April* 1961).

In summarising this sixth conference on lighthouses, etc. held at Washington, D.C., in September 1960, mention is made of the great variety of topics discussed of interest to lighting engineers and others. The 156 papers included ones on flashing lights, with special reference to microsecond flash lengths, the use of xenon short-arc lamps and of acrylic plastics, data on colour thresholds and of the influence of colour on glare, and sources of power for operating unattended lights. A proposal which is to receive further study is that the intensities of navigation lights should be identified by a decibel notation. P. P.

628.971.6

1051. The concept of luminance in connection with street lighting.

L. STARBY, *Ljuskultur*, **33,** 60–61 (No. 2, 1961). *In Swedish.*

The relation between the illumination falling on a road surface and its visible brightness is more complex than for interior lighting because of the partly specular reflection characteristics of the road surface. Measurements were made on a dry road surface and the uniformity of luminance compared with that of the incident illumination; the ratios were $E_{min} : E_{av} : E_{max} :: 1 : 4 : 8$ and $L_{min} : L_{av} : L_{max} :: 1 : 2 : 4$. Details of the installation are given. Measurements of the visibility of grey square card test objects were made. R. G. H.

628.977

1052. The new lighting control installation at the Stockholm Royal Opera House.

Ljuskultur, 90–92 (No. 2, 1961). *In Swedish.*

The new system for the lighting of the Royal Opera House controls up to 500 kw. The transductors consist of two parallel reactors with high permeability cores. The operation of the system with special reference to control of the colour of the light is described. R. G. H.

1053. Maintenance factors for interior lighting. 628.93

R. N. EDWARDS Jr, *Illum. Engng.*, **56,** 355–361 (*May* 1961).

The 1959 American IES illumination recommendations relate to minimum maintained values. Strictly, the individual factors which determine the minimum conditions in a lighted interior should be separately considered, rather than that a single maintenance factor for design purposes should be adopted. The more precise allowance would include a lumen depreciation factor, dependent on the type of lamp used and the proposed replacement programme, and a dirt depreciation factor for both lamp and fitting, dependent on the cleaning schedule. Depreciation of room surface reflectivities would be separately considered. The proposals are illustrated by data and worked examples in which group versus random lamp replacement is considered for fluorescent and

mercury vapour lamps and where new test data are offered based on measurements of the dirtying of fluorescent fittings in air-conditioned offices. P. P.

1054. Partners in visual comfort. 628.972

Illum. Engng., **56,** 329–331 (*May* 1961).

Opticians share with lighting engineers the responsibility for visual comfort and health. With this in mind, photographs and detailed descriptions have been prepared showing the way in which the consulting rooms of two opticians have been lit to produce good diffusion and comfortable luminance ratios under the variable lighting levels required for different examination procedures. In one consulting room, the lighting can be dimmed so that glasses can be prescribed under the same conditions as in the patient's place of work. P. P.

1055. Accidents, statistics and street lighting. 628.971.6

H. J. TURNER, *I.E.S. Lighting Review* (*Australia*), **23,** 55–60 (No. 2, 1961).

Describes investigations made in Sydney during the last two years on the effect of street lighting on road accidents. A statistical analysis of the results tends to support the findings of the British Road Research Laboratory that street lighting would reduce night road accidents by 30 per cent. A cost analysis indicates that accident reduction through street lighting would produce an economic saving at least equal to the lighting cost. Significant savings in journey time costs would also be achieved through street lighting. W. R.

1056. Public lighting by regional lighting authorities. 628.971.6

J. H. MORRISON, *Public Lighting*, **26,** 89–100 (No. 2, 1961).

This paper presented at the Public Works and Municipal Services Congress 1960, discusses at some length the present administration for the provision and maintenance of street lighting in this country. It describes the setting up of consultative committees on the lines of the London Conurbation and quotes the constitution of such committees already formed, such as those serving the Manchester area and the South East Lancashire area. It suggests that the country be divided into regional areas (excluding the County Boroughs) which would cut down the number of lighting authorities, at present 8,866 in England and Wales, to something of the order of 175, basing the suggested size per authority on a population of approximately 200,000 people. Several informative tables dealing with road mileage and the financial aspects of the proposals are shown. Finally, the author briefly sets out the layout for a model street lighting department. B. C. O.

628.92

1057. Daylight and supplementary artificial light in rooms for work, as exemplified by school rooms.

E. DAHMEN, *Lichttechnik*, **13,** 311–316 (*June* 1961). *In German.*

The author has studied the use of supplementary artificial lighting in school classrooms and lays down certain conditions that should be fulfilled. In particular the general character of the lighting should be similar to that of the daylight as regards colour, diffusion, direction, uniformity and freedom from glare. Details are given of specific installations, special attention being paid to the diversity factor which can be considerably reduced by the artificial lighting. Curves are given to enable estimates to be made of the hours during which artificial lighting will be needed in a particular room at different times of the year in Berlin. J. W. T. W.

1058. Light and architecture. 628.9

D. STRÖBEL, *Lichttechnik*, **13,** 305–311 (*June* 1961). *In German.*

One of the papers read at the symposium in Berlin on 'Light in and for buildings' (see LIGHT AND LIGHTING, *November* 1960, p. 297). The author showed a series of pictures illustrating his various points. He said that light could be used to emphasise architectural form or simply to make it visible after dark. Architects were becoming aware of the possibilities now offered them by modern lighting and light sources. One architect's buildings were deliberately designed to have a certain form by day and a different one by night. The style adopted for the lighting could depend on the character of the building. The paper has thirty-four reproductions of photographs of notable installations. J. W. T. W.

1059. Ceiling brightness control. 628.972

K. C. WELCH, *Illum. Engng.*, **56,** 365–367 (*June* 1961).

Working from the premiss that diffuse lighting is best for reading, and that this is ideally achieved by low-brightness overhead lighting naturally decreasing from ceiling to floor, the author describes a children's room in the Carnegie Library, Sparta, Michigan, in which this premiss is carried into practice. Two invented troughs at 6 ft 9 in. mounting height conceal six 8 ft very-high-output fluorescent lamps shining on to a ceiling where the brightness gradation is limited by painted bands of differing reflectances. Acceptable daylighting conditions result from a north-facing window glazed with grey (50 per cent transmission) glass. P. P.

628.971.6

1060. Fluorescent lighting for the high-speed expressway.

W. J. MCCORMICK, *Illum. Engng.*, **56,** 384–388 (*June* 1961).

The 32-mile section of the Trans-Canada Highway, known as the Metropolitan Boulevard, which traverses the island on which Montreal is located, will, when completed in about two years' time, be lit by about 7,000 fittings. An initial 7-mile section has already been lit. The specification for the fittings had to take account of ambient temperatures ranging from −40°F to +100°F and wind speeds up to 100 m.p.h. Extra-high-output fluorescent lamps using argon-neon or argon-helium in vapour-pressure-controlled tubes gave the necessary performance under the low operating temperatures. By suitable choice of lamps, fittings and spacing, the design illumination level of 1 lm/ft² has been achieved with a diversity ratio of 2·6:1. P. P.

1061. Designing for a low-budget school. 628.972

A. A. BINDER and G. J. OAKLEY, *Illum. Engng.*, **56,** 373–375 (*June* 1961).

Within a tight budget, the St Francis of Assisi School, Ridgefield Park, New Jersey, has been lit in accordance with the new American IES recommendations. The main hall, which has to serve for a multiplicity of purposes, presented particular lighting problems. The way these were solved within the budget is outlined. The lighting of the classrooms to a level of 100 lm/ft² is also described. P. P.

535.2:628.93

1062. Nomenclature and symbols associated with radiation transfer calculations.

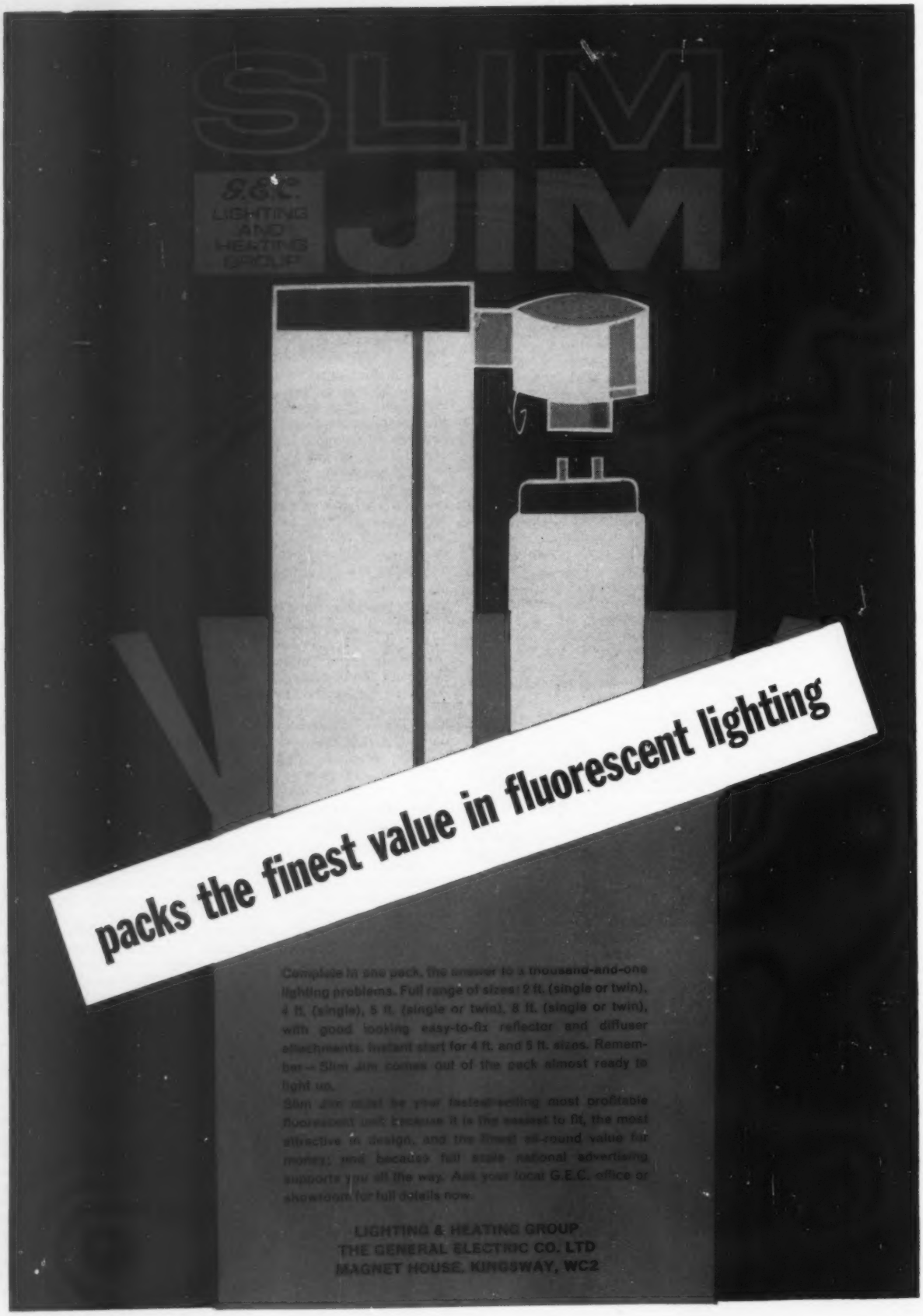
Trans. Illum. Eng. Soc. (*London*), **26,** 136–142 (No. 3, 1961).

Certain concepts concerned with the transfer of radiation between the two surfaces are common to both heating and lighting engineers. It is shown, however, that these concepts are currently identified by a number of widely differing terms and symbols. The present Report, prepared for the NIC Fundamental Principles of Lighting Sub-Committee, proposes, for general adoption, three terms—Configuration Factor, Exchange Coefficient and Form Factor—together with associated symbols. An appendix shows the way in which the proposals have been developed, in particular giving reasons for the choice of terminology and symbols. P. P.

1063. The long-range forecasting problem of meteorology.

SIR GRAHAM SUTTON, *Trans. Illum. Eng. Soc.* (*London*), **26,** 127–134 (No. 3, 1961).

For the purpose of this Trotter-Paterson Memorial Lecture, 'long-range' is identified as of the order of a month. The physical conditions influencing the weather at any particular time are outlined and thus the forecasting problem can be stated. Forecasts based on weather-lore are considered. Various attempts at a statistical approach to forecasting are described, including ones based on observed variations in the energy output of the sun. An alternative approach which is made possible by modern high-speed electronic computers is to construct a mathematical 'model' of the dynamic conditions producing the weather. P. P.


SLIM
G.E.C.
LIGHTING AND HEATING GROUP
JIM
packs the finest value in fluorescent lighting
Complete in one pack, the answer to a thousand-and-one lighting problems. Full range of sizes: 2 ft. (single or twin), 4 ft. (single), 5 ft. (single or twin), 8 ft. (single or twin), with good looking easy-to-fix reflector and diffuser attachments. Instant start for 4 ft. and 5 ft. sizes. Remember—Slim Jim comes out of the pack almost ready to light up.
Slim Jim might be your fastest-selling most profitable fluorescent unit. Because it is the easiest to fit, the most attractive in design, and the finest all-round value for money; and because full scale national advertising supports you all the way. Ask your local G.E.C. office or showroom for full details now.
LIGHTING & HEATING GROUP
THE GENERAL ELECTRIC CO. LTD
MAGNET HOUSE, KINGSWAY, WC2

NEW PRODUCTS

Transformer mounted l.v. spotlight

SIMPLICITY OF INSTALLATION is the feature of the new TI.40 spotlighting fitting announced by Courtney, Pope. It consists of a 12v, 50w reflector lamp housed in an aluminium spinning attached to a knuckle joint mounted on a case containing the l.v. transformer supplying the lamp. Combined

New l.v. spotlight which incorporates a transformer in its base for ease of installation.

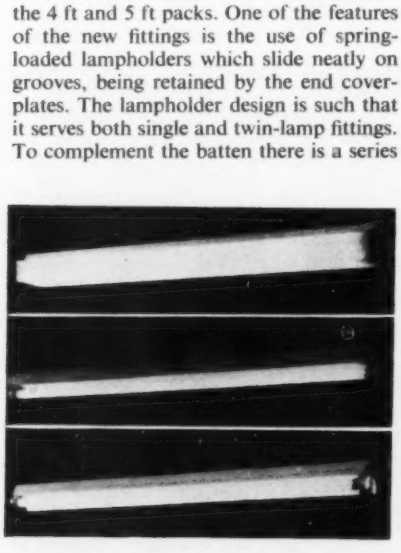
with its compact size—the transformer case is 4¾ in. by 3½ in. by 2¾ in. and the spinning 4½ in. long by 3 in. diameter at its mouth—and the provision of a keyhole slot, the fitting may be installed virtually anywhere as required for display lighting purposes.

*Courtney, Pope (Electrical) Ltd, Amhurst Park Works, London, N*15.

Slim fluorescent fittings

'Slim Jim' is the name given to a new range of fluorescent fittings introduced last month by the GEC. Packed complete with warm white lamp, the new fittings are available in sizes from 8 ft, 125w to 2 ft, 20w with single and twin versions in all but the 4 ft, 40w size. Instant start is standard in the 4 ft and 5 ft packs. One of the features of the new fittings is the use of spring-loaded lampholders which slide neatly on grooves, being retained by the end cover-plates. The lampholder design is such that it serves both single and twin-lamp fittings. To complement the batten there is a series of reflector and diffuser attachments which, designed to blend as coherent parts of the unit, can be fitted to most single and twin-lamp versions of the series. To simplify installation and maintenance the reflectors are held in place by a snap-fit catch which can be rapidly released. Price of the single 5 ft batten is £4 16*s.* 6*d.* including p.t. and surcharge; 'Diakon' diffuser attachment is £2 2*s.* extra and stoved enamel reflector £1 3*s.* extra.

*The General Electric Co Ltd, Magnet House, Kingsway, London, WC*2.



Three versions of the new 'Slim Jim' range of fluorescent fittings illustrating the types of reflector and diffuser available.

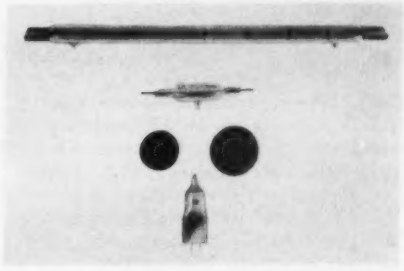
Fittings for high output tubes

In what is probably the first commercial use of the 'high power' fluorescent lamp, Vanguard Engineering Co announce the introduction of a 5 ft fluorescent fitting using a 125w lamp instead of the more usual 80w lamp. The fitting is available as a simple batten unit and also as an industrial trough reflector, in both single and twin lamp versions. The lamps, which are made by Philips, are available in the standard and reflector versions. The fitting is supplied complete with lamp at a price of £6 15*s.* (standard) and £6 17*s.* (reflector tubes); corresponding prices for the trough fitting are £7 18*s.* and £8. Light output of the two lamps is 6,125 and 5,425 lm, and illumination levels, measured directly under the centre of the fittings with no allowance made for inter-reflections, are, at 10 ft mounting height, 6 and 13 lm/ft² for the two types of lamp respectively; comparative figures for a single 5 ft 80w batten and 8 ft 125w batten are 4·3 and 6·6 lm/ft².

*Vanguard Engineering Co, Commonwealth Factory, Woolwich Church Street, London, SE*18.

Iodine-quartz lamps now available

The commercial availability of iodine-filled quartz-tube filament lamps was announced by two firms recently. First was Osram who are to market the first of a range of small-size lamps which they claim may revolutionise large-area lighting in the next few years. First applications of the new lamps are floodlighting or projection. A demonstration installation has been provided at Luton airport in a glide approach indicator system, where 96 lamps of 200w rating are being used successfully; they give 15 per cent more light than the lamps in standard use on airfields and have 2½ times the life. This type is on sale and although of higher first cost than the corresponding conventional lamp, it will show considerable saving over a period. Another form of lamp in development is a tubular filament type in ratings of 500, 1,000 and 1,500w for floodlighting and area lighting; it is to become available shortly and is also designed to give 15 per cent more light than its conventional equivalent. Looking further ahead, a third form of GEC iodine lamp is being developed. It is a 100w projector lamp no larger than pigmy lamps used for Christmas decoration sets and is intended for 8 mm projectors.



Three new Osram iodine-quartz filament lamps; top is the 1,500*w tubular version, centre the* 200*w lamp used at Luton Airport and bottom the* 100*w lamp for* 8 *mm projectors.*

The other development is from Atlas and takes the form of a tubular lamp, available in a rating of 625w at 118v; it has dimensions of 75 mm length and 12·5 mm diameter. The lamp's light output is 21,000 lm and its life is about twice that of a 500w reflector photoflood. The lamp is designed for use in compact lighting fittings for cinematographic and photographic flood-lighting and is suitable with both colour (type A) amd monochrome film.

Osram Lamp Division, The General Electric Co Ltd, East Lane, Wembley, Middlesex.

*Atlas Lighting Ltd, Thorn House, Upper St Martin's Lane, London, WC*2.

Café au clair

A CONTINENTAL IDEA for domestic lighting, recently introduced into this country, gives the 'table lamp' a new twist. It takes the form of a coffee table, designed in the contemporary idiom, above which are suspended a pair of lamps in bask raffia shades of red and primrose, hanging from two

Recently introduced from the Continent is this combined lamp standard and coffee table

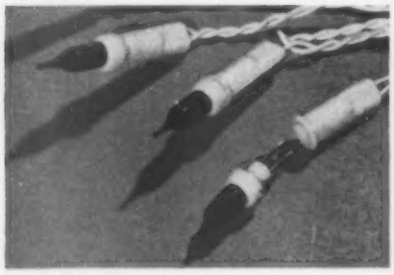
brass tubes attached to the table. The table, 13 in. high, is bound in brass and surfaced in a black and primrose mosaic of ceramic tiles and supported on three ebonised legs. Overall height is 5 ft 5 in.
Uncles Bliss and Co Ltd, New Parade, Cherry Orchard Rd, East Croydon, Surrey.

Cadmium sulphide photoconductive cell
Now available in this country is a new cadmium sulphide photoconductive cell for photometric applications particularly where low illuminations levels are to be measured. The cell, developed by the Canadian firm National Semiconductors Ltd and marketed in this country by Hird-Brown, has a spectral response similar to that of the eye

New CdS cell, 1¼ in. long by ⅜in. diameter, showing the curved rectangular window.

and will operate in illumination levels from 0·01 to 1,000 lm/ft. It is said to be 1,000 times more sensitive than selenium cells of equal area. The material has a low temperature coefficient and there is virtually no 'dark adaptation' or 'light fatigue'. The cell is cylindrical in shape, with a curved rectangular window and is hermetically sealed.
Hird-Brown Ltd, 244 Marsland Road, Sale, Cheshire.

Decoration lamp sets
The latest range of Piselli decoration lamp sets features two-pin jewel lamps and weatherproof outdoor lighting sets which should appeal to many commercial organisations who wish to provide the same sparkle to their frontage decorations as to their interior decorations. In common with

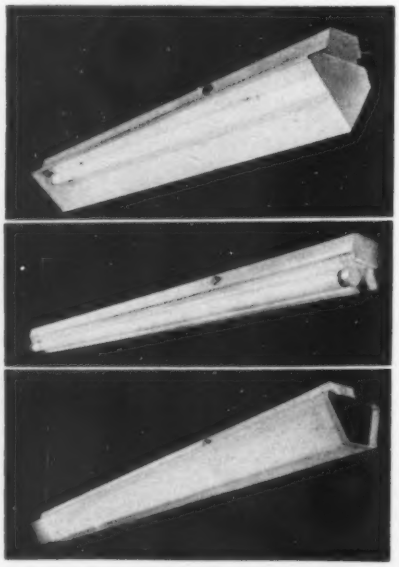


New Piselli decorative lamps with plug-in caps.

earlier designs, the lamps are guaranteed for 1,000 hours operation and incorporate a secondary circuit ensuring that if one lamp fails, the remainder stay alight.
Insley (London) Ltd, 5 Windmill Street, London, W1.

Long-life quality lamps
A high-quality lamp is the newcomer to the Crompton Parkinson range for the current lighting season. Known as 'Golden Crompton', the lamps are made in small batches from selected materials of high quality and during manufacture undergo rigid control and inspection. Each lamp, moreover, is time-delay tested before despatch to eliminate the risk of early failures. The result is a lamp of longer life and more superior performance than conventional g.l.s. lamps; it is also designed to operate satisfactorily where voltage variations may be experienced, being less affected by surges. Since the lamp needs no testing before sale, it is sealed in a metallised plastic foil bag.
Crompton Parkinson Ltd, Crompton House, Aldwych, London, WC2.

New fluorescent range from Ekco
To fill the gap between their de luxe 'Essex' range and their low-price 'super Slim' packaged fittings, Ekco-Ensign have introduced a new range of industrial, commercial and decorative fluorescent fittings known as the 'Durham' range. By a careful choice of two or more popular styles in each category, the firm has produced a medium-sized range containing fittings suitable for a wide variety of applications. It features a lampholder which has a spring mounting, to make for good electrical contact, robustness, and cheapness in production. The fittings themselves are based on standard single or twin-lamp spines, supplied complete with control gear and lampholders ready wired; each fitting is available in a 4 ft, 5 ft and 8 ft version, with switch or switchless start. Cover plates, reflectors and diffuser suspension plates are interchangeable and it is therefore a simple matter to convert from one type to another to suit the different uses to which an interior may be put. The catalogue describing the range contains the BZ classification and lighting performance data for each fitting. A single lamp 5 ft batten fitting costs £5 2*s.*, and as a diffuser fitting £9 10*s.* plus 17*s.* 9*d.* p.t.
Ekco-Ensign Electric Ltd, 45 Essex Street, Strand, London, WC2.



Three fittings of Ekco-Ensign's new 'Durham' range, showing the diffuser and angle reflector.

Trade Literature

CANDELL LTD, Riverside Works, Broadmead Road, Woodford Green, Essex. Full reference to this firm's tungsten lighting fittings is provided in a new catalogue, sectionalised into commercial, multiform, utility, display and lantern ranges and accessories.

AEI LAMP AND LIGHTING CO LTD, Melton Road, Leicester. The AEI range of opal glassware, recently extended by several new designs, is detailed in a new catalogue; reference is simplified by division into three main sections (pendants, ceiling and wall fittings, and glassware) and use is also made of the new product numbering which is related to an electronic computing and accounting system. A new price list for 'Satina' fittings giving the new product numbers has also been issued.

Ekco-Ensign Electric Ltd, 45 Essex Street, Strand, London, WC2. New catalogues and price lists for the firm's lamps and fluorescent fittings, including the new 'Durham' series.

Linolite Ltd, 118 Baker Street, London, W1. Catalogue no. 48 details the company's latest range of fittings, strip reflectors and signs using double-capped tubular filament lamps and fluorescent lamps. There is also a separate leaflet emphasising the space-saving qualities of 'Linora' reflectors.

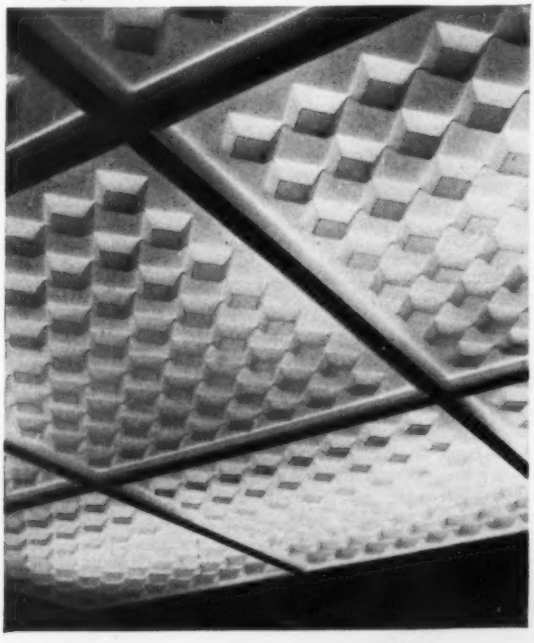
Holophane Ltd, Elverton Street, London, SW1. The use for emphasis lighting in shops and stores of Holophane 'Louvrelens' prismatic glass fittings is reviewed in a new publication 6108.

English Glass Co Ltd, Leicester. 'Little things in glass' is the title of a new catalogue which details a variety of glass products made by the firm, notably domes for warning and indicators lights of various kinds, optical mouldings and preforms for glass to metal seals.

Thorn Electrical Industries Ltd, Great Cambridge Road, Enfield, Middlesex. This is an interesting booklet setting out lighting applications for electroluminescence and the firm's 'Panelume' lamps which make use of this principle.

Cryselco Ltd, Kempston Works, Bedford. Two catalogues listing the firm's current range of lamps and fluorescent and tungsten lamp fittings for industrial and commercial applications.

Diffusing panels made from vacuum-formed 'Flovic' by S. C. Errington (Hanwell) Ltd., Uxbridge Road, Hanwell and fitted in a showroom at Messrs. Harold Webb Motors Ltd., London Road, Hadleigh, Essex.



For luminous ceilings such as this specify 'Flovic'

The diffusers used in this luminous ceiling are tough, free from the risk of discoloration, resistant to burning and optically very efficient. They are vacuum-formed from 'Flovic', an I.C.I. plastics material, special grades of which have been formulated for luminous ceilings. The profile pattern can be chosen to suit the site and can, where necessary, be specially designed to give the lighting designer the effect he requires.

If you would like more detailed information on the properties of 'Flovic', any I.C.I. Sales Office will be pleased to help you.

See the I.C.I. Plastics in Building Exhibition at
THE MANCHESTER BUILDING CENTRE LTD., 115 PORTLAND STREET, MANCHESTER, 1. 8TH—17TH NOV.

'FLOVIC'

'Flovic' is the registered trade mark for the vinyl copolymer foil manufactured by I.C.I.

ICI

PFL 7A
IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

IES Activities

MORE THAN TWO HUNDRED IES members and visitors attended the current session's inaugural meeting of the Society last month to hear Mr W. T. Souter present his Presidential Address, although the meeting was, of course, concerned with other matters as well. The first item was the presentation of the second IES Gold Medal, to Mr H. C. Weston. The presentation was made by the retiring President, Dr W. S. Stiles, who recalled that the Gold Medal had been instituted to mark the occasion of the Society's Golden Jubilee and was awarded at intervals of not less than two years for outstanding contributions to the advance of lighting. It had been a unanimous decision of the IES Council that the second medal should be bestowed on Mr Weston for his important contributions to lighting from the early 'twenties onwards including his work on all the editions of the IES Code. In calling upon Mr Weston to receive the medal, Dr Stiles said that in every field of endeavour there were, from time to time, certain researches or series of researches which came to constitute the corner stones on which future constructions were erected and Mr Weston's work was of that nature.

Dr Stiles then announced that the Leon Gaster Memorial Premium had been awarded jointly to H. R. Ruff, H. E. Bellchambers and G. K. Lambert for their paper, 'Modern aids to lighting design—computer techniques', which was presented to the IES in January, and presented certificates of the award to the three authors. He then called upon Mr Souter to present his Presidential Address.

Presidential Address

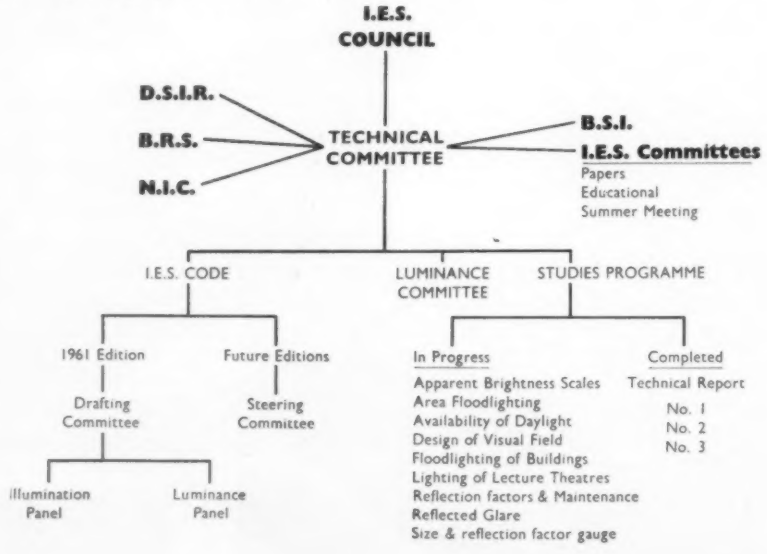
On the theme of the Society's contribution to lighting technology, Mr Souter pointed out that the influence of the Society in illuminating engineering technology became evident only three years after its foundation when the Home Secretary in 1912 appointed a departmental committee to investigate lighting conditions in factories and workshops. The IES was strongly represented on this committee and its formation was largely inspired by one of the factory inspectors who was also an enthusiastic IES member. The first report, published in 1915, paved the way for the subsequent report and recommendations which were given statutory status. Then came the DSIR's committee on illuminating engineering, in 1917, on which the IES was represented by five of its members. Subsequently operating as the Illumination Research Council, this committee was responsible for a considerable number of publications dealing with natural and artificial lighting. A technical committee has been a feature of IES organisation as far back as 1928. Part of its work was liaison with the DSIR on various subjects, notably the studies on illumination being carried out by Mr H. C. Weston. It was also responsible for post-graduate studies on opal glassware undertaken in 1934 by Mr (now Dr) W. E. Harper.

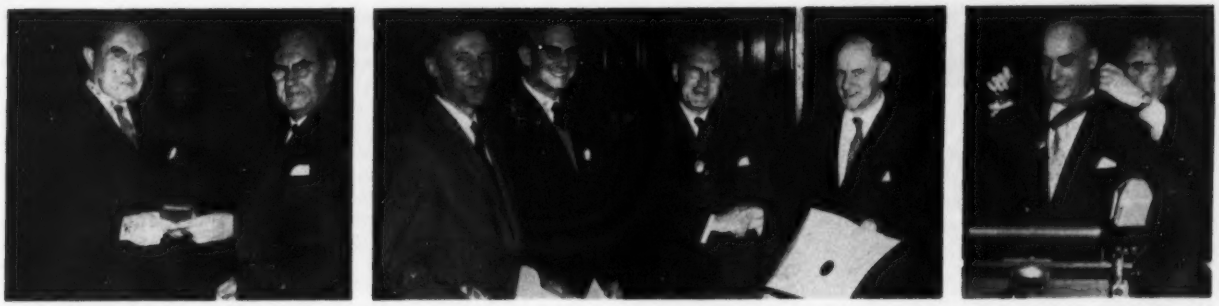
In the years immediately preceding and during the second world war, the Society was able to give a variety of services to the government; the preparation of specifications for ARP lighting was fundamental to the success of the lighting measures associated with civil defence. Attention was also turned to lighting in the reconstruction following the war, and in anticipation of the growing consciousness of the importance of lighting in the individual, the IES set up a committee to study the problems. Two parallel approaches were established, one dealing with the lighting problems associated with schools, public buildings, offices, factories and natural and artificial lighting techniques and the other concerned with legal aspects of different classes of installations. It was possible to complete several of the studies with the publication of a series of pamphlets, the influence of which can be seen, for example, in the lighting regulations set out in the school premises regulations of 1951.

Mr Souter then went on to review some of the events in the life of the IES Code, starting with Lythgoe's original analysis of the visual task in terms of the size of the actual detail of the object under fixation, its contrast with the immediate background and the brightness of the more immediate surroundings, touching on Weston's translation of this theory into a practical relationship with illumination and on other work on seeing conditions and glare which culminated in the present Code introduced at the meeting of the IES at which the Duke of Edinburgh was presented with his Certificate of Honorary Fellowship. He also wove into his account the threads of the parallel work on flux distribution which resulted in the IES Technical Report No. 2, pointing to the fortuitous and brilliant conception that the British Zonal method of classification should be employed to interpret the BRS glare constant in terms of glare index values. It was a breakthrough of major importance in an aspect of lighting design which had hitherto defied measurable analysis and had the great merit that illumination values, brightness environment and glare indices can be calculated from the same basic photometric data. He also mentioned that the next IES Technical report, which deals with the lighting of building sites and works of engineering construction, and lays down provisions for desirable standards of temporary lighting in the interests of safety and efficiency, was due to be published shortly.

As seen from the accompanying diagram, the current programme of the technical committee includes a variety of subjects on which reports will follow in due course and will be of great interest and practical value to members and to industry. One particular activity of the Technical Committee is its liaison with universities and technical colleges in promoting research studies by students. The subjects proposed are of an academic nature which would not normally be undertaken by the photometric laboratories of sustaining members but would still be of great value to the Society, and this

Organisational structure of the Illuminating Engineering Society's technical activities, showing the relationship of the IES Technical Committee to other parts of the Society and to outside bodies, its sub-divisions devoted to the Code, Luminance (Technical Report No. 2) and its future programme.





At the inaugural IES meeting of the new session, left, Dr W. S. Stiles presenting the IES Gold Medal to Mr H. C. Weston; centre, G. K. Lambert, H. E. Bellchambers and H. R. Ruff with Dr Stiles after presentation of the Leon Gaster Memorial Premium Certificates; right, Dr Stiles investing the new President, Mr W. T. Souter, with his badge of office.

activity can be a means of encouraging greater interest in lighting as a career.

The work reviewed by Mr Souter was seen as approaching 'the end of the beginning', in the sense that the primary concern in the last fifty years has been improving standards of adequacy of illumination within the economic limitations of energy, light sources and equipment. During this time the less tangible factors related to the comfort of seeing conditions have assumed greater importance and although the work on glare is a major step forward in reducing one of these intangibles to a condition in which it can be treated mathematically, it must necessarily be consolidated by further studies and field work, supplemented by further work on some of the other intangibles, such as brightness differences and indirect glare. In fact, with the present trend towards much higher illumination levels in offices and other interiors, the problem of reflected glare must become one of the priorities in the Society's programme of future studies. All in all, the profession was crossing the threshold of brightness engineering and future studies will necessarily be concerned with the evolution of a satisfactory and convenient technique by which it will be possible to design the flux distribution and most suitable brightness values in all areas of an interior which together comprise the visual field.

In the Centres

In the opening meeting of the Birmingham Centre, Mr S. C. Dinenage presented his address as chairman on 'The cost of light', based on the premiss that 'the activities of a civilised community depend increasingly on the provision of light, adequate and suitable for its purpose, for its continued expansion, development and evolution'. Never before had it been possible to provide abundant cool light so easily and cheaply. New installations should be planned with foresight so that at their half-life, they could still bear favourable comparison with current schemes, whilst high illumination installations may well offer better employment of the capital invested in them, as the cost of energy is an appreciably higher proportion of the running cost than lamp replacement. Artificial light was becoming a supplement, if not a replacement, for daylight, in view of the high cost of providing the latter. Satisfactory daylighting of an industrial interior might require roof glazing of at least 25 per cent of the floor area, resulting in a heat loss of 40 per cent of the total heat input. Elimination of the roof glazing might well result in sufficient reduction in the capital cost of the heating plant as to pay for the lighting installation involved.

IES News

At its last meeting the IES Council elected Mr Granville Berry and Dr H. D. Einhorn into Fellowship of the Society. It was also agreed to award diploma membership to J. H. Howard, F. M. Pigott and A. Wilson.

Forthcoming events

LONDON

November 14

Changes in the dimensions of incandescent lamps, by A. G. Penny; a standard heat test lamp for the temperature testing of lighting fittings, by J. N. Bowtell and J. R. Coaton; temperatures in lighting equipment with incandescent lamps, by J. Keen and H. F. Stephenson. Federation of British Industries, 21 Tothill Street, SW1, 5.30 p.m.

CENTRES

November 1

EDINBURGH. The association of light and colour, by A. D. Charters. YMCA, 14 South St Andrew Street, 6.15 p.m.

NEWCASTLE-UPON-TYNE. Office lighting: Symposium by J. K. Boud and E. B. Sawyer. Room B7, Percy Building, King's College, 6.15 p.m.

SWANSEA. The new IES Code, by W. E. Harper. S. Wales Electricity Board, The Kingsway, 6 p.m.

November 2

BIRMINGHAM. Ladies' Night. Botanical Gardens, Edgbaston, 7.30 p.m.

CARDIFF. The new IES Code, by W. E. Harper. Bowchier Hall.

NOTTINGHAM. Traffic signals, by B. M. Cobbe. Electricity Centre, Carrington Street, 6 p.m.

November 8

BATH AND BRISTOL. Joint meeting with BLC and Somerset Society of Architects; speakers: John Reid, R. L. C. Tate. Royal West of England School of Architecture, Great George Street, Bristol.

MANCHESTER. Annual dinner, Cafe Royal, Peter Street, 6.30 p.m.

November 9

MANCHESTER. Lighting for Christmas, by E. P. Lee. N.W. Electricity Board, Town Hall Extension, 6 p.m.

November 13

SHEFFIELD. The new IES Code, by H. E. Bellchambers. Sheffield University, Western Bank, 6.30 p.m.

STOKE-ON-TRENT. Lighting journey down the Rhine, by E. J. Smith. North Stafford Hotel, 6 p.m.

November 14

GLASGOW. The mining electrical engineer looks at lighting, by J. Rae. Joint meeting with AMEME. Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Street, 6.30 p.m.

November 20

BATH AND BRISTOL. Lighting for photography, by R. W. Unwin. Grand Hotel, Bristol.

LEEDS. Continental lighting practice, by A. W. Gostt. BLC, 24 Aire Street, 6.15 p.m.

November 21

LIVERPOOL. Office lighting, by R. G. Hopkinson and J. Longmore. Industrial Development Centre, Paradise Street, 6 p.m.

NORTH LANCS. The new IES Code, by W. Robinson. N.W. Electricity Board, 19 Friargate, Preston, 6.30 p.m.

November 24

CARDIFF. Dinner Dance, St Mellons County Club.

GLASGOW. Luncheon meeting, Grand Hotel, Charing Cross, 12.30 p.m.

LEICESTER. Social evening, Coronation Hotel, Catherine Street, 7.45 p.m.

November 27

BIRMINGHAM. Lighting of large office buildings, by J. H. D. Madin. Chamber of Commerce, 75 Harbourne Road, Edgbaston, 6.30 p.m.

MISCELLANY

Book Reviews

'Ophthalmics in Industry' by Robert J. Fletcher, MSc(Tech), FBOA (Hons); published by the Hatton Press, London, 1961; pp. 159, price 36s.

This is an interesting book on a subject complementary to that of lighting in industry, since the intelligent practice of both specialities rests upon an adequate knowledge of visual capacities and of the demands made upon them by the varieties of work in industry. Primarily, Mr Fletcher's book is intended to help those trained in ophthalmic optics and optometry to apply their basic knowledge to the furtherance of industrial visual comfort, efficiency and safety, and this it should do very well. However, Chapters 3 and 5 in particular should be instructive to students of lighting engineering and these chapters make up nearly half of the book. The rest is concerned with the development of industrial visual hygiene, the sight screening of industrial personnel (for which the author has designed a new instrument) and consideration of the ocular hazards and injuries in industry. In dealing with visual task analysis, the author recommends computing the apparent size of critical details in prism dioptres but, as conversion to minutes of arc is necessary for practical purposes, the method of the IES Code is more direct. One is surprised to read on p. 102 that 'fluorescent lights emit radiation at twice the frequency of tungsten lamps'. The book utilizes over 200 illustrations, many of them from photographs. The numerous graphs and line drawings are clear enough although some of them are poorly drawn. Although many authors are cited in the text, references to their relevant publications are omitted. However, there is a selected bibliography of industrial vision following a very brief appendix on the essentials of ocular anatomy, and there is an adequate index.

H. C. W.

'Photometric Standards and the Unit of Light' by J. S. Preston, MA, MIEE, FInstP, FIES, NPL. Notes on Applied Science No. 24. Published for DSIR by HMSO, pp. iv, 32; 6 in. by 9½ in.; price 3s. (by post 3s. 4d.).

The subject of this monograph is the historical evolution of light standards and the way in which the NPL today maintains a steady unit and scale for the measurement of light. The first part traces the development of light sources from the early nineteenth-century and the evolution of the present primary standard. In its main part, the booklet explains how the NPL maintains the unit of light, how it prepares and calibrates standard lamps, and work which goes on behind the scenes to ensure the closest possible agreement with similar measurements made in other official laboratories throughout the world. An appendix describes a possible new basis for the unit of light. This monograph will not only appeal to the specialist but will also provide a useful and reasonably complete reference source in its field for other scientific laboratories, for manufacturers of all types of lamps, and for others engaged in the general field of illuminating engineering.

L. L.

Education

A SERIES OF THREE illustrated lectures on 'Modern Architecture: Yesterday, today and tomorrow' are to be given this month at the RIBA by Mr R. Furneaux Jordan, previously Principal of the Architectural Association School of Architecture and Professor of Architecture at Leeds University. The lectures will be held on November 15, 22, 29, beginning at 6 p.m. Admission is by ticket only, price 6*s.* for the complete series, 2*s.* 6*d.* for a single lecture, obtainable from the Secretary, Royal Institute of British Architects, 66 Portland Place, W1.

WE HAVE BEEN ASKED to point out that in our report last month of the results of the City and Guilds Examinations, Intermediate Grade, Second Class, C. L. Ashley should have read L. A. Clements, C. A. Crainger should have been C. A. Grainger and J. B. Love should have been T. B. Love. It is also regretted that C. L. Thorndycraft and W. C. Wyatt were omitted from the list of successful First Class, Intermediate Grade candidates.

Personal

Thorn Electrical Industries Ltd announce the appointment of five Executive Directors —Mr J. G. CHRISTOPHER, Mr V. COFFEE, Mr A. J. FORD, Mr D. A. NEILL and Mr G. J. STROWGER. All are senior executives and directors of subsidiary companies and together with the present Board will be responsible for the management and direction of the company's affairs.

Atlas Lighting Ltd announce the appointment of Mr J. E. WOOLDRIDGE as Sales Supervisor for their South-Western Area, and of Mr J. L. MURPHY as Sales Supervisor of their Marine Lighting Dept.

Mr K. H. VERNON has been appointed lamp and lighting representative for North Wales under the Liverpool branch of Philips Electrical Ltd. He succeeds Mr G. T. JONES who is now branch manager at Liverpool.

Mr JAMES WELSH, Glasgow Area Sales Superintendent of AEI Lamp & Lighting Co Ltd since 1955 retired in September. After a period with a Glasgow firm of electrical wholesalers he joined Metro-Vick Supplies Ltd in 1925 and subsequently served with Edison-Swan until taking up his last appointment. For 15 years he was hon treasurer of the Glasgow IES Centre.

Mr FRANK PEARCE, formerly with Troughton & Young, has been appointed Senior Contracts Engineer with Mortimer, Gall & Co Ltd.

Rowlands Electrical Accessories Ltd announce that Mr G. GARDNER who for some years was their sales representative in the North-West has been appointed to succeed the late Mr J. L. Hill in the London area. Mr E. W. BAILEY has been appointed to the North-Western area.

Industrial Notes

THE MANCHESTER SOCIETY OF ARCHITECTS has moved to the Manchester Building Centre, 115 Portland St, Manchester 1 (tel: CEN 9802). All correspondence and mailing and the sale of RIBA publications, is now undertaken from this office; outside office hours, messages may be left by using the telephone answering service operated by the Building Centre. The library, council and meeting rooms will not move to the centre until 1963.

THORN ELECTRICAL INDUSTRIES announce the opening of a new depot in Belfast to handle all Group products, including Atlas lamps and lighting equipment. The depot, managed by Mr R. A. Bibby, is at 10 Severn St, Belfast 4 (tel: 56004).

THE THREE LONDON sales areas of the GEC Lighting and Heating Group have now been merged into one London area sales organisation operating from new headquarters at Lena Gardens, Hammersmith, W6 (tel: RIV 4671). The new organisation, headed by Mr S. E. Mason, will offer full sales and technical services; Mr J. T. Mellor is Technical Services Manager and Mr T. E. Pickering chief lighting engineer for the area. The Group's offices and trade counter at Hanger Lane, W5 have now been withdrawn.

THE NOTTINGHAM OFFICE of AEI Mazda has moved to Ashforth St, Alfred St Central; the telephone number remains 51115. The same firm's Gloucester office has moved to Merchants Rd (tel: 27663).

A NEW LONDON sales office is announced by Rowlands Electrical Accessories. It is at Regent House, 89 Kingsway, WC2 (tel: HOL 3361).

BENJAMIN ELECTRIC have opened a Scottish Office, at 259 Vincent St, Glasgow, C2, where a representative selection of commercial and industrial fittings for tubular fluorescent, mercury and filament lamps

is now displayed together with outdoor fittings and floodlighting lanterns. Mr J. M. Anderson, recently appointed manager for Scotland and Northern Ireland, will operate from the new premises.

HAVING NOW HAD several months production experience with their new 'Atlantic 2' fluorescent fittings, Atlas have been able to re-assess cost figures with the result that certain prices have been reduced from October 1.

THREE LIGHTING FIRMS gained awards in this year's RIBA competition in manufacturers' trade and technical literature. In group I (*a*) Courtney, Pope (Electrical) received an honourable mention and in group I (*c*) Falk Stadelmann and Co were awarded the certificate of exceptional merit whilst the General Electric Co received an honourable mention. Pilkington Brothers were awarded a certificate of merit in group II. The essential requirement for entering this competition is that literature shall be of the international standard size. Entries are now invited for next year's competition; they have to be submitted by April 30.

BLC Activities

LECTURE ACTIVITIES arranged by the Council for November include the following:

November 1
*Canterbury, office lighting conference. The justification of good lighting, by J. Smyth; The application of lighting to commercial buildings, by D. R. Griffiths. *Newcastle, office lighting conference. Speakers: J. K. Boud, E. B. Sawyer. *Birmingham, office lighting conference. Speakers: J. G. Holmes, A. D. S. Atkinson.

November 2
*Birmingham, office lighting conference. Speakers: R. R. Holmes, D. R. Griffiths.

November 3
*Birmingham, office lighting conference. Speakers: L. H. Hubble, A. Wilcock.

November 7
*Maidstone, for architects and electrical interests. The new IES Code, by BRS staff.

November 9
Oxford, for electrical interests. The new IES Code, by J. T. Grundy.

November 14
Newcastle upon Tyne, College of Technology, for executive trainees. Factory lighting, by R. A. Hall.

November 16
Eastbourne, for SE Electricity Board contractors. Selling home lighting, by J. F. Roper.

November 23
Croydon, architects' conference. The new approach to artificial lighting, by R. G. Hopkinson; The application of artificial lighting to offices, shops and homes, by A. Wilcock.

St Albans, for building industry representatives. The correct combination of natural and artificial lighting, by A. D. Charters.

An open invitation is extended to readers to all meetings marked with an asterisk. It will be appreciated if those wishing to attend lectures and conferences associated with the BLC office lighting campaign would give prior notice to their nearest BLC Regional office. Information on all BLC meetings can be obtained from the BLC Regional Engineer concerned.

Situations

Vacant

SENIOR LABORATORY ASSISTANT (age 25–40) to be responsible for photometric and thermometric work on lighting fittings and associated problems. Work includes interesting development of techniques and apparatus allied to design of lighting fittings. Knowledge of glass, plastics, electrical circuitry and fundamental problems of vision in artificial light would be helpful. Some personal contact with clients, technical associations and manufacturers will be necessary. Company pension scheme. Salary according to ability and experience (Diploma Membership of IES would be an advantage). Apply fully, marking envelope 'Confidential', to Mr J. G. Holmes, Technical Director, Holophane Ltd, Westminster, SW1.

ESTIMATOR required NW London. Experience in metal work and electrical engineering essential. Salary according to experience. Good prospects. Write Box No. 733.

AREA REPRESENTATIVE, resident in Birmingham Area, required by Lighting Fittings Manufacturers. Car Provided. Contributory Pension Fund. Apply giving age and experience to Box No. 734.

JUNIOR LIGHTING ENGINEER required to assist in preparation of schemes and tenders. Modern Office in Hammersmith. Apply Box No. 735.

APPLICATIONS are invited for the position of MANAGER within a lighting company dealing with the manufacture of festive and industrial cable lighting systems. Rapid expansion has been made in both home and export markets. The successful candidate should preferably possess HNC (Electrical) and hold membership of the Illuminating Engineering Society. He should also have the ability to design decorative lighting schemes and have experience in electrical accessory and contracting fields. Apply, giving full details of age, education, and experience to: The Personnel Office, D.R. Illuminations Ltd, Warren Street, Stockport, Cheshire.

Please address replies to Box Numbers to 'Light and Lighting', 32 Victoria St, SW1.

NORTHAMPTON COLLEGE OF ADVANCED TECHNOLOGY, LONDON
DEPARTMENT OF APPLIED PHYSICS

Applications are invited for the post of TECHNICAL ASSISTANT to assist in research on Subjective Brightness. The work is being sponsored by the DSIR and the appointment is in the first place for three years. Applicants should hold a University Degree or equivalent qualification. Ability to assist in the construction of research apparatus is essential.

Salary £800 p.a. Application forms and further particulars may be obtained from the

Head of the Applied Physics Department,
St. John Street,
Clerkenwell,
London, E.C.1.

PHILIPS ELECTRICAL LTD.
require a
LIGHTING ENGINEER

in Southern England. Dip. MIES preferable but qualifications less important than previous experience in this specialist field. Personal qualities are necessary for this position particularly ability to negotiate at all levels.

This is a rare opportunity to join a constantly expanding organisation, offering progressive conditions of employment, including attractive starting salary, contributory pension scheme, etc. Car provided. Please write giving full particulars to the Personnel Officer (M/810/2),
Century House, Shaftesbury Ave., London, W.C.2.

Postscript

MANY OF MY READERS will, by now, have seen the report by the Parliamentary Committee on Estimates which has recently pronounced on school building. The Building Regulations and particularly those dealing with daylighting came in for some stiff criticism on the score that they have led to the construction of 'glass palaces'. The regulations dealing with artificial lighting escaped lightly, but I noted the following exchange of conversation—*The Chairman:* Do you know what a foot-lambert is? *Answer:* I think it is two per cent of the daylight outside. *The Chairman:* Yes, that is roughly it. There were some other gems of technical information of a similar kind. It is very easy for us technologists to deplore this kind of thing, but it demonstrates some failure on our part to convey to non-technical administrators just what our aims in our professional life are. The committee would have been wise to call some expert witnesses at the start to put them straight on their facts. I am sure that Dr Walsh could have told them what a foot-lambert was. If they had had it explained to them that the regulations call for no more than the light of ten ordinary candles round a child's desk, or a 100 w lamp hung 3 ft above the desk, they would have understood just how much or how little were those ten lumens which bothered them so much. It is certainly not for me, a layman, to criticise the architecture of modern schools. I feel the Committee is right to ask for a curb on the excessive use of glass, and of course the recent work of the Ministry of Education and the Building Research Station has been directed toward that end. On the other hand, we do not want to revert to the old sham Gothic school building with its small high windows. Two of my family attended such schools, and one of them is quite sure that she has been deprived of something good by not having been able to go to a 'new school'. (The other is quite insensitive to his surroundings and could not even tell me, when I asked him, what colour his classroom walls were.) The Committee also criticised the use of 'expensive blinds'. I cannot understand this. The sky varies so much in brightness from winter to summer that obviously windows which will let in enough light in winter must be screened in summer. Why is the use of a 'thermostat' sanctioned as an essential part of a heating system, yet a 'photostat', which is what blinds and curtains are, criticised as an expensive luxury? I also notice that the Committee looked favourably on supplementary artificial lighting. The IES Code has appeared very opportunely, in this connection as in many others.

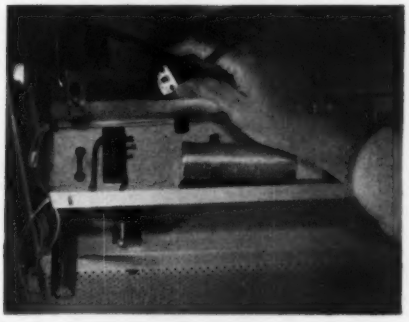
THE USE NOW BEING MADE by the police of the 'Identikit' to build up a portrait of a suspect in order to assist identification recalls to me the vogue some years ago for photographic composite portraits, following the technique which was first developed, I believe, by Sir Francis Galton, and described in his *Inquiries into Human Faculty*. There was a famous composite portrait of Gilbert and Sullivan which figured as a frontispiece in a biography which I read as a boy. Really good composite portraits are, of course, very tricky to construct. A number of photographs of people must be produced to the same average size—one method is to mark two spots on the enlarging easel to represent the pupils of the eyes, and then to adjust the degree of enlargement until the pupils on the negative coincided with these marks. Hence no matter what the size of the original negative, a print will result with the eyes the same distance apart. When one has a set of prints produced in this way, they are then laid in turn on a table protruding through which are two pin points the same distance apart as the eye distance. The prints, one at a time, are then set with the pupils located on these points. Each print must now be photographed in turn on to the same film, giving each only a fraction of the total exposure necessary to obtain a well-exposed negative. The final negative, when developed, bears the composite image. It is not easy to obtain results which bear comparison with those of Galton, but with only a little trouble one can obtain portraits which are amusing. Family likenesses are quite easy to show up, and victims like to study the picture intently to see if they can recognise their own peculiarities in the composite portrait. Galton, of course, had a serious purpose in mind in developing this technique, as he thought that he might be able to demonstrate the characteristics of certain mental or physical disorders as a means of assisting diagnosis. With long experience many physicians are able to make a good guess at a diagnosis by a person's general appearance. Galton's technique would assist young diagnosticians to do this without waiting for the experience. I do not know if it has ever been used since his time for the purposes which he had in mind, but the 'Identikit' derivative does seem to have produced some useful results. It is particularly interesting that a quite simple vocabulary of basic 'features' in the kit produces such useful results. The human brain is able to integrate a range of attributes and arrive at a general assessment in a way which we are only just beginning to understand. I fear that it will be a long time before we can construct a simple instrument which will put a reliable figure of merit on a lighting installation which will supplant the human judgment, but this is what we are being pressed on all sides to do. Since the publication of the IES Code, many engineers and users are demanding a simple Glare Meter which, when pointed at an installation, will read off the Glare Index. At a recent IES meeting, one bold spirit suggested that there was no insuperable difficulty in constructing such a meter, but it would probably cost at least £300. Knowing how little one can get these days in the way of scientific instruments for £300, I feel that he was being optimistic. But there is certainly the need for such an instrument, even at a high price, if it could be made available on loan and kept in reliable calibration. The original photometers were expensive for their time, and there were few of them. In those days those who possessed them used to be called in as consultants to make illumination readings. This might well be the procedure now with the glare meters until such time as they can be simplified and miniaturised as light meters have been since the advent of the cheap barrier layer rectifier cell.

'Lumeritas'

ALLOM HEFFER

AND COMPANY LIMITED

1



2

3

The 707 range of Recessed Modular Fittings incorporates all the refinements necessary for quick fixing and easy maintenance.

Pictorially are shown the salient points:

1 Finger tip fixing (quick fix catch Patent Application No. 39587/60).

2 Plug and socket connection.

3 Detachable and hinged gear trays.

4 A pull-push method of opening and shutting diffuser, which can be hinged and detached.
(Locking device—Patent application No. 32933/59).

Apply for leaflet Series 707

Barbour Index File No. 263

4

17 MONTPELIER STREET · KNIGHTSBRIDGE · LONDON · SW7 · KNIGHTSBRIDGE 6897-8

G.E.C. post top lanterns

give Birmingham's Inner Ring Road a new high standard of illumination

Lighting-up time in Birmingham will see a new standard of after dark safety on the city's 3¾ mile long 110 ft. wide dual carriageway ring road, already partly constructed.

An overall light intensity of at least 30,000 lumens was specified for the new road, this from lanterns spaced at 100 ft. intervals on the outer kerbs. To achieve this, Sir Herbert J. Manzoni, C.B.E., the City Engineer and Surveyor, called in the G.E.C. Lighting Division to develop his design for a new type of post-top lantern housing three 400w colour corrected mercury lamps.

This is the kind of combined operation the G.E.C. Lighting Division welcomes. It challenges its experience, advances still further its knowledge and makes another British road safe after lighting-up time.

The specially designed post-top lanterns are 4 ft. 6 ins. in diameter, approximately 18 ins. deep, and consist of a domed canopy and dished translucent Perspex bowl. Access to the three Osram 400w colour corrected mercury lamps is remarkably simple. The 30 ft. high slender steel poles are made by Stewarts & Lloyds.

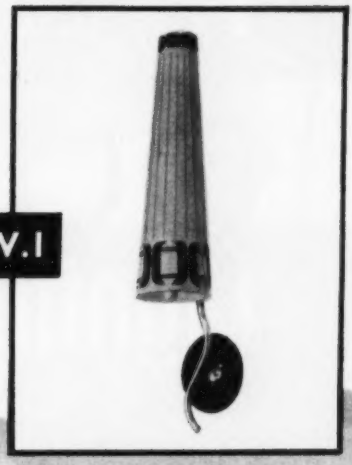
G.E.C.
LIGHTING
AND
HEATING
GROUP

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

New! Gay! Gaylux

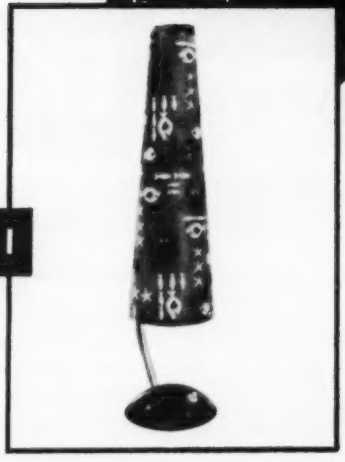
GXW.2

with FIESTA shades



GXW.1

with SPARTA shade



GX.1

with MARINE shade

GAYLUX fittings represent a revolutionary advance in decorative lighting and offer untold scope to the imagination in preparing modern lighting schemes.

The slender GAYLITE shades are available in a fascinating variety of colours and patterns.

For full descriptive details please send for illustrated Leaflet No. 50.

LINOLITE

LINOLITE LIMITED

Sales & Export Depts., Showroom & Trade Counter:
118 BAKER STREET, LONDON, W.1 Telephone: WELbeck 1159 & 1150
Head Office & Factory:
THE MILL WORKS, MALMESBURY, WILTS Telephone: 2240

NEW DURHAM RANGE

Lighting Fittings

PRODUCED BY EKCO

* Competitive price
* Quality materials and manufacture
* Wide range of quick-fix reflectors and diffusers
* Easy installation and maintenance
* Switchstart and quickstart throughout range
* Superbly engineered

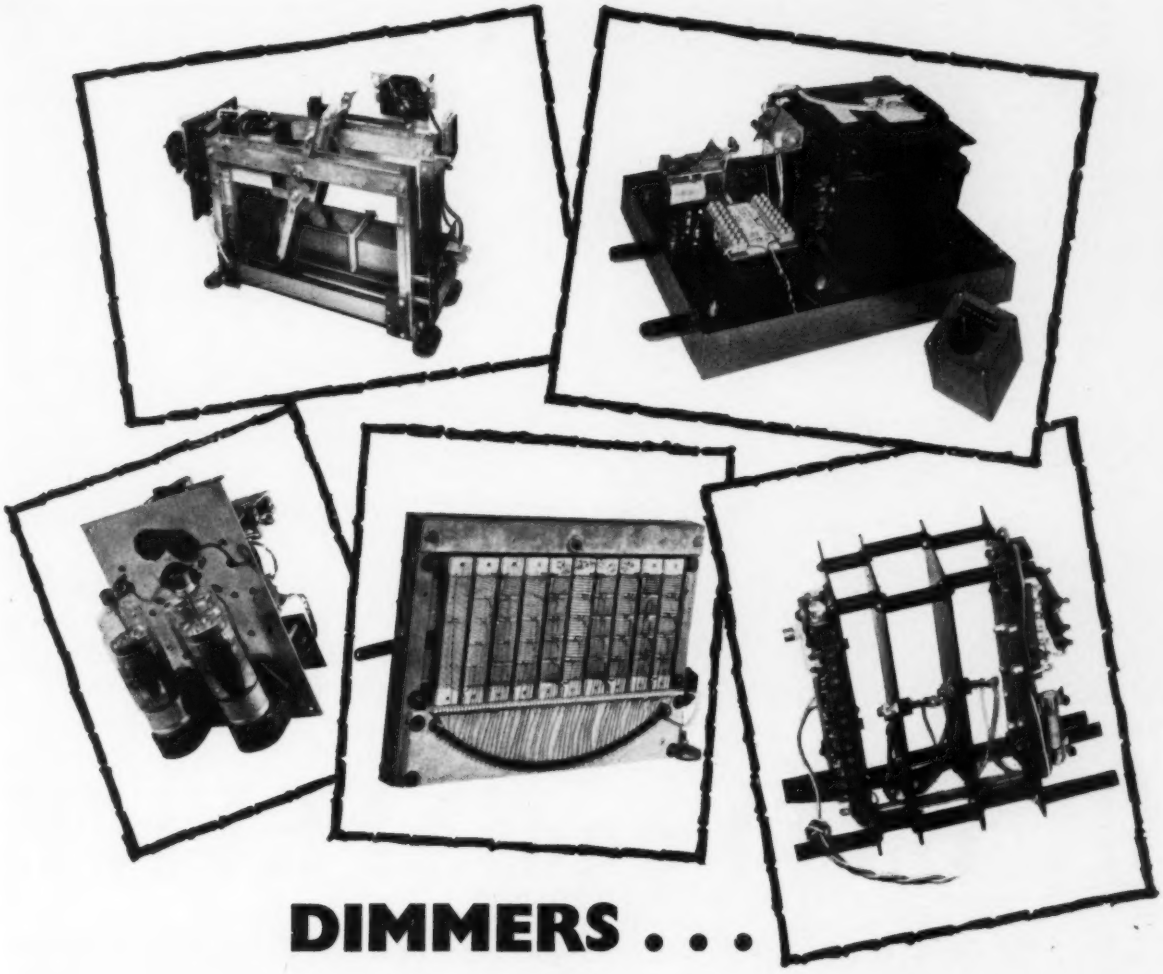
LIGHTING ADVISORY SERVICE

Ekco-Ensign operates a Lighting Advisory Service throughout Great Britain. Qualified Lighting Engineers will be pleased to call on you, discuss your particular problem and prepare detailed lighting schemes. This service is entirely free and without obligation.

Ekco-Ensign Electric Limited *45 Essex Street, Strand, London WC2. Telephone: CITY 8951*

Sales Offices, Illuminating Engineering Depts., Showrooms and Depots: LONDON · MANCHESTER · BIRMINGHAM · NOTTINGHAM · GLASGOW · CARDIFF

TA 6154

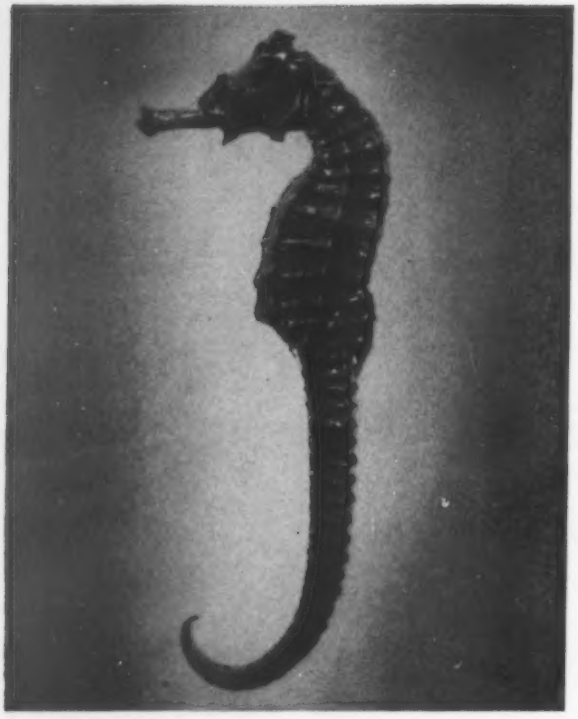


DIMMERS . . .

Yet another dimmer — the Silicon controlled rectifier — has been launched by Strand. Already there are the saturable reactor, the thyratron, the auto-transformer and even the resistance dimmer is still with us. Dimmers form the basis of lighting control systems of all kinds, remotely or directly operated, and from large installations of 200 or more channels for opera and TV Studios down to a simple 4-dimmer junior control for a village hall. Essentially the dimmer is but a component in the all-important lighting control system itself. Which form of dimmer to use for any purpose is a matter for very careful consideration and it by no means follows that the latest is the best for every situation. But Strand Electric, because they make them all, will be able to give you completely disinterested advice on the subject.

STRAND ELECTRIC

THE STRAND ELECTRIC & ENGINEERING CO., LTD. 29 King Street, Covent Garden, London, W.C.2. Temple Bar 4444



Quality in Nature, Sea-horse

CRYSELCO

lamps and fittings can be obtained from any of fourteen branches and depots throughout the country.

All CRYSELCO business is based upon a policy of Quality and Service.

This attention to detail in production and distribution, coupled with more than 60 years' experience in lamp manufacture, ensures quality products, promptly delivered.

The range of lamps and fittings available is extensive. If you have not received the current catalogue, please send for one today.

QUALITY and SERVICE

CRYSELCO BRANCHES
are situated throughout the country.

Their aim is to give you quality products plus good service.

CRYSELCO Managers in the following towns and cities would be pleased to hear from you.

BEDFORD
BIRMINGHAM
BRISTOL
BURY ST EDMUNDS
CARDIFF
GLASGOW
LEEDS
LEICESTER
LIVERPOOL
LONDON
MANCHESTER
NEWCASTLE
NOTTINGHAM
SOUTHAMPTON

CRYSELCO LIMITED
KEMPSTON WORKS **BEDFORD**

Service by Sea, Queen Mary *(Photo Cunard Steamship Co Ltd)*

TWO FACTORS

Contribute to the Superiority of
WILSON *Illuminated Ceilings*

★**CIRCLGRID**
Non-burning, rigid vinyl louvers

★**LUMATRAX**
Ultra-narrow (½") quick-mount suspension system

U. L. APPROVED
For use under sprinkler systems
U.S.A. Tunnel Test Rating – 20

Ageless in beauty . . . versatile in performance, Wilson Illuminated Ceilings are rapidly becoming the architect's favourite lighting system for new construction or relighting.

★The thousands of tiny circles forming the louvers in CIRCLGRID vinyl transmit soft diffused light permitting glare-free lighting in the order of 200-foot candles if required. CIRCLGRID 2′ x 2′ panels consist of two sheets of rigid, self extinguishing vinyl electrically welded for great structural strength . . . with weight of only 3½ ozs./sq. ft.

These popular CIRCLGRID louvers meet rigid fire code standards for city buildings . . . they possess acoustical properties, permit air conditioning systems to function efficiently and the louvers are easily cleaned by rinsing in mild detergent.

★LUMATRAX exposed grid system offers the advantages of narrow support members and simplicity of installation. The tracks level quickly and perfectly by Wilson's exclusive spring clip. LUMATRAX is available in ½" E section in the United Kingdom . . . and 15/16" T section in the U. S. A.

In other words, Wilson Illuminated Ceilings are recognized by leading architects and contractors as the outstanding system in the lighting field.

Write for Circlgrid and Lumatrax technical literature concerning the installation you are now working on.

Manufactured and distributed in the United Kingdom by

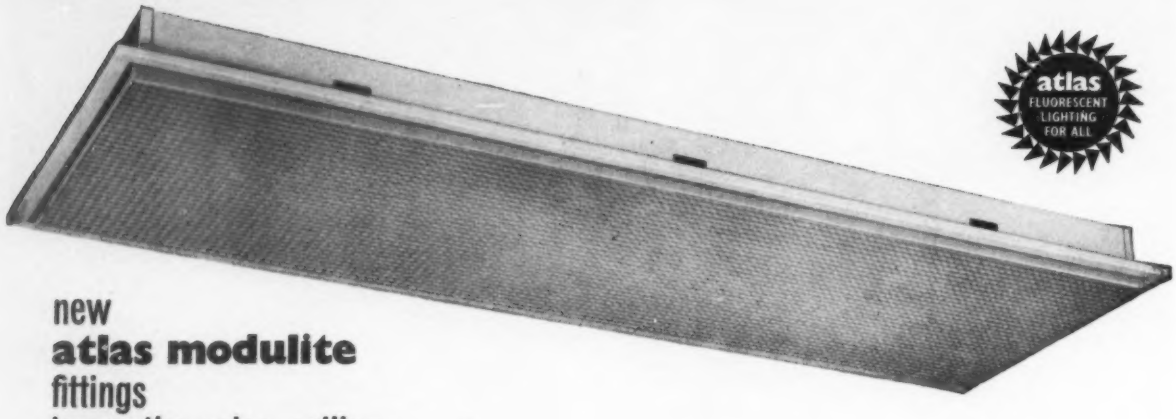
Harris & Sheldon ELECTRICAL Ltd

WILSON

COMPLETE LIGHTING SPECIALISTS AND MANUFACTURERS OF LIGHTING FITTINGS
46 GREAT MARLBOROUGH STREET, LONDON W1 • GERrard 0869
Head Office and Works: 31 STAFFORD STREET, BIRMINGHAM • CENtral 6272

International Wilson Affiliates
U.S.A., J. A. Wilson Lighting • CANADA, J. A. Wilson Lighting Ltd. • AUSTRALIA, Greendale Engineering Company
SOUTH AFRICA, New-Era Lighting • MEXICO, Quinzanos

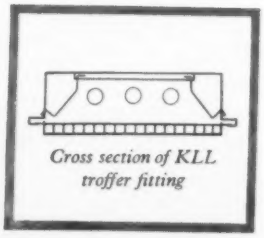
Patented or Patents Pending



atlas FLUORESCENT LIGHTING FOR ALL

new **atlas modulite** fittings lower the price ceiling of 'modular' lighting

The new Atlas **Modulite KL** Series of troffer fittings bring 'modular' lighting into the 'popular' price range. These fittings are extra shallow, only $3\frac{1}{2}$" deep, and lightweight, great advantages when it comes to installations where the tiles are fitted close to the true ceiling. Like all Atlas Modulite fittings, the KL Series is designed for easy and neat installation, and to allow for easy maintenance after fixing. Three elegant Atlas diffusers complete the picture, Translucent 'Perspex', Interlocking Vinyl Sections, and Shallow Plastic Louvre. All three are available in 2, 4, 6 and 8 ft. lengths on a 2 ft. module, or for continuous mounting.



Cross section of KLL troffer fitting

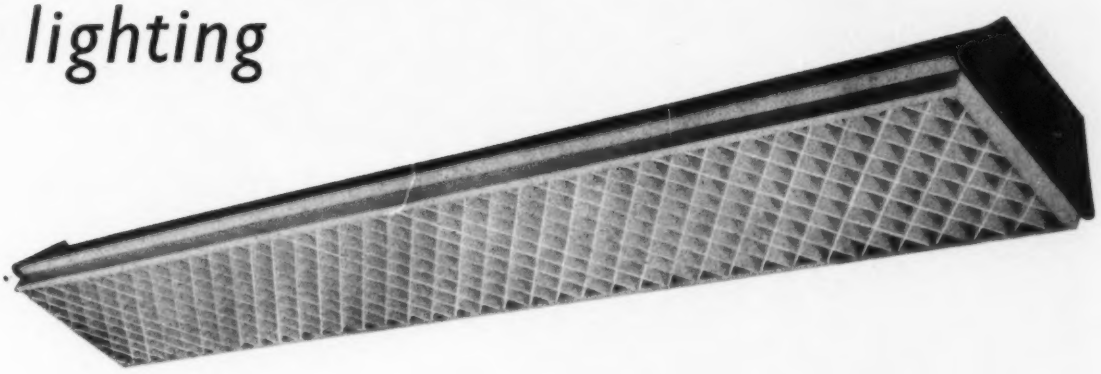
Barbour Index No. 200

atlas Atlas Lighting Ltd • Thorn House • Upper St. Martin's Lane • London WC2 DTV

Patented or Patents Pending

November, 1961

plastic components in lighting



1

1 Complete light diffuser fabricated from moulded and extruded plastics. Produced for A.E.I. Lamp & Lighting Co Ltd.

2 'Elcoplas' louvre ½" mesh x ½" depth, Diamond or Square Mesh. Registered Design No. 873594.

3 'Elcoplas' louvre 1$\frac{3}{16}$" mesh x 1" depth, Diamond or Square Mesh.

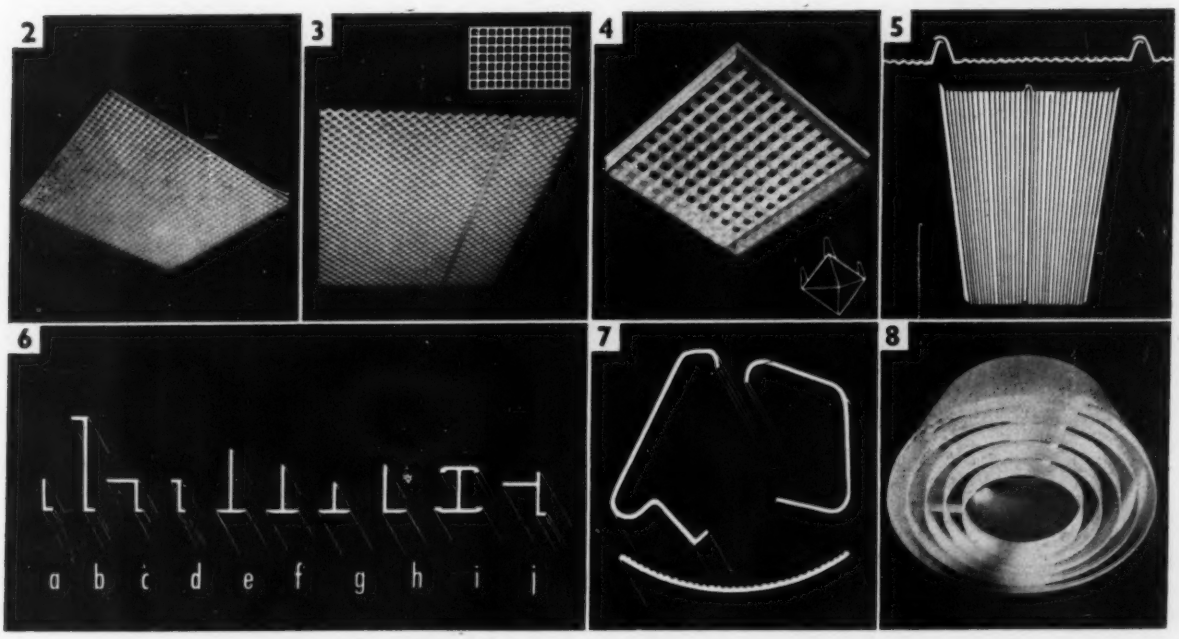
4 'Elcoplas' modulus louvre 2" mesh x 1¾" depth, Diamond or Square Mesh, illustrated with plastic 'Z' framing. Coloured Pyramids in five different colours available for fitting into the cells.

5 'Plasmatic' diffuser panels available in opal, pearl, clear. Interlocking panels are 10½" centre to centre, and are supplied in maximum lengths of 4 ft, or less to order.

6 Plastic supporting sections.

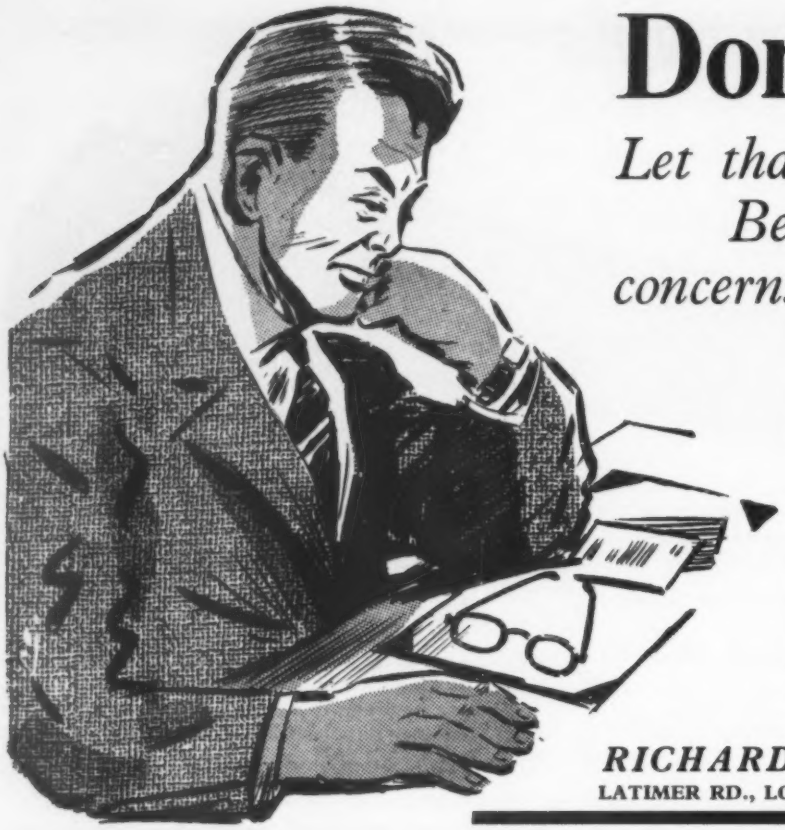
7 Typical sections of plastic extruded diffusers, as supplied to lighting fitting manufacturers.

8 Moulded plastic shade and louvre as produced to the design of Messrs Hume Atkins & Co. Ltd. (Registered Design No. 880153).



ELCO PLASTICS LTD Desborough Park Road, HIGH WYCOMBE Bucks.

Telephone: HIGH WYCOMBE 4111/4



Don't

Let that PROBLEM Beat You . . . If it concerns the extrusion of "ACRYLIC"

Our wide experience on the extrusion of ACRYLIC diffusers for fluorescent lighting fittings can help you too! We are specialists—and our range of Industrial services cover EVOLITE ACRYLIC TUBING EXTRUDED SHEETS AND SECTIONS, also Fabricating, Moulding, Turning and Engraving in "PERSPEX."

RICHARD DALEMAN LTD.,
LATIMER RD., LONDON, W.10 Tel: LADBROKE 7455

INDEX TO ADVERTISERS

	Page
A.E.I. Lamp and Lighting Co. Ltd.	ix
Allom Heffer and Co. Ltd.	xv
Atlas Lighting Ltd.	xxii
Crompton Parkinson Ltd.	cover iii
Cryselco Ltd.	xx
Richard Daleman Ltd.	xxiv
Ekco-Ensign Electric Ltd.	xviii
Elco Plastics Ltd.	xxiii
Eleco Ltd.	iv
General Electric Co. Ltd. (Lighting and Heating Group)	xiii, 344, xvi
General Electric Co. Ltd. (Osram Lamp Division)	i
Hailwood and Ackroyd Ltd.	cover ii
Harris and Sheldon (Electrical) Ltd.	viii, xxi
Holophane Ltd.	cover iv
Imperial Chemical Industries Ltd. (Plastics Division)	347
Linolite Ltd.	xvii
Lumitron Ltd.	vi
Major Equipment Co. Ltd.	ii
Philips Electrical Ltd.	v
Phosco Ltd.	iii
Poles Ltd.	x
Satchwell and Gittings Ltd.	x
Shell Chemical Co. Ltd.	xiv
S.L.R. Electric Ltd.	ii
Stanton and Staveley Sales Ltd.	vii
Strand Electric and Engineering Co. Ltd.	xix
Victor Products Ltd.	xii
Wardle Engineering Co. Ltd.	vi
Wokingham Plastics Ltd.	xi

. . . A TOTALLY-ENCLOSED REEDED DIFFUSER WITH END-PLATES IN colour

Here's lighting with a new look for stores and offices . . . a range of beautifully finished fittings combining the quality of 'New-Range' with a choice of three colours for the dished end-plates. The reeded opal plastic diffusers spring easily into position on the standard 'New-Range' chassis, and form a close dust-tight fit all round it. In 5ft. or 4ft. sizes, one or two lamp fittings with end-plates in red, primrose, or cerulean blue enamel; high power factor switch-start or snap-start control gear, and spring-loaded bi-pin lampholders.

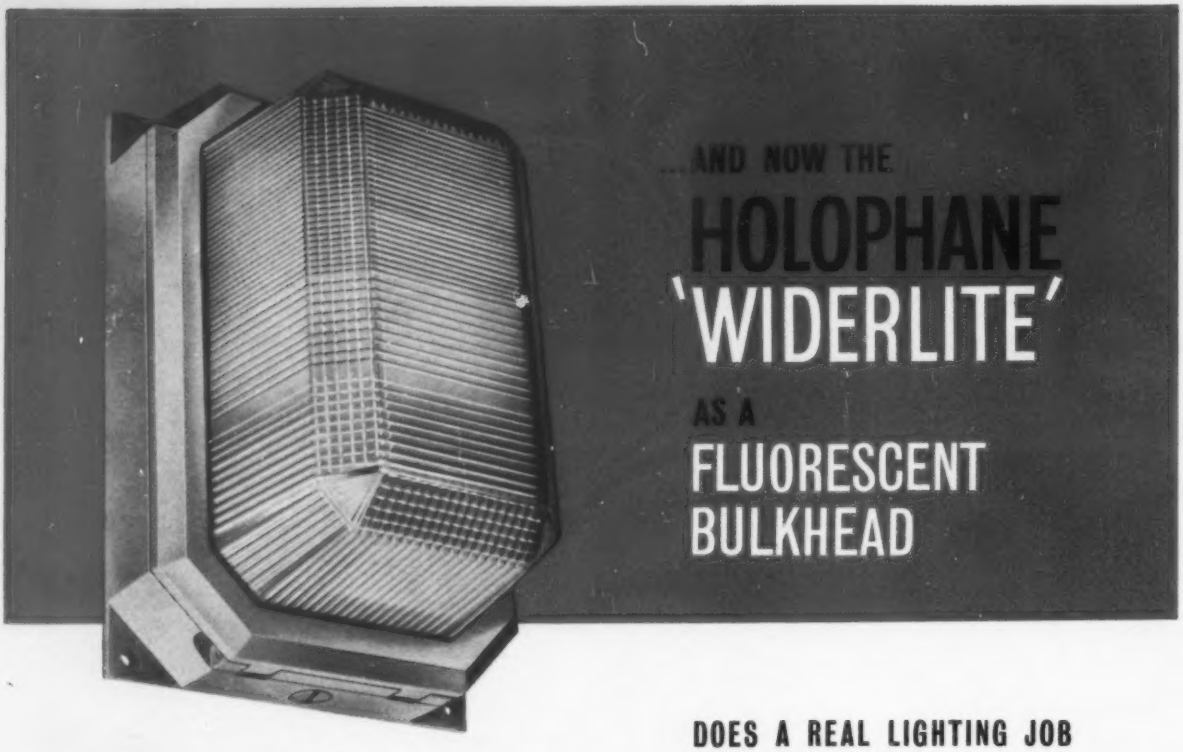
By Appointment To Her Majesty The Queen Manufacturers of Electric Lamps

Crompton 'New-Range'

FLUORESCENT LIGHTING FITTINGS

ELECTRICAL EQUIPMENT

CROMPTON PARKINSON LTD., CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2.



With the compact dimensions of the 50w MBF/U lamp, choke and capacitors, Holophane offer their famous "Widerlite" bulkhead as a fluorescent unit having all the essential features for dependable bulkhead lighting:

1 Holophane prismatic glassware, for durability and control.
2 Body casting in silicon-aluminium alloy, highly resistant to corrosion.
3 Maximum protection against lamp breakage.
4 Compact design; will fit anywhere.
5 Rubber gasket prevents entry of dust and moisture.
6 Concealed hinge allows the cover carrying the front glass to be opened giving access to interior.
7 Integral choke and power factor correction capacitor wired to terminal block.
8 50w MBF/U lamp provides 1,350 lumens throughout life of 5,000 hours with good colour correction.*

For surface mounting, top and bottom entries tapped for ¾ in. conduit (side or back entries available as extras).

Exterior measurements: $11\frac{5}{16}$ x $7\frac{5}{16}$ x $5\frac{1}{2}$ in., weight 8 lb.

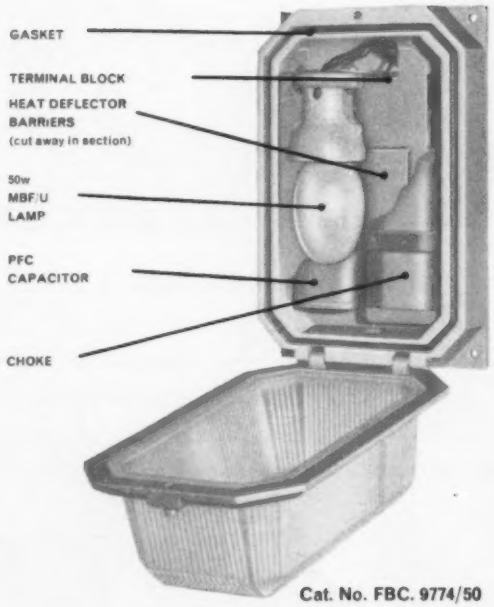
Standard finish: Light Grey BS colour 631.

Note: For installations where PF correction is not required or where bulk PF correction is operating, the fluorescent "Widerlites" can be supplied without capacitors. All fittings are suitable for installation in ambient temperatures up to 35°C wall mounting and 25°C ceiling mounting.

*(Holophane do not supply the lamps)

DOES A REAL LIGHTING JOB
fluorescent-wise

Full light control plus
high engineering quality



Cat. No. FBC. 9774/50

HOLOPHANE

HOLOPHANE LIMITED · SCIENTIFIC ILLUMINATING ENGINEERS
ELVERTON ST · WESTMINSTER · LONDON SW1 TEL: VICTORIA 8062